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REVIEW OF MINING

INTRODUCTORY. — Business during the closing month of the year suffered from the election and the holidays, both tending to divert attention from the making of money. The General Election disappointed the majority of stock-brokers, but when the final result indicated "no change," they became less despondent and remembered that even during a Liberal administration the City had had a lively oil boom and a gorgeous rubber excitement, not to mention other financial flutters of an agreeable kind. The excellent monetary position, the splendid Board of Trade statistics, and the extinction of several impending labour strikes all helped to gladden the brokers and jobbers, as well as their clients, the speculators and investors to whom London is the great exchange and mart. Christmas on the Stock Exchange was properly celebrated by an incident, not so unusual as to be astounding but not so frequent as to pass without mention. A client who failed to meet his differences about 20 years ago for an aggregate sum of £30,000 repaid these losses to the brokers and bankers to whom it was owing, despite the fact that he was under no legal liability to do so.

TRANSVAAL.—The November output was considered satisfactory, having regard to the fact that it was a short month. Indeed, the public pays but slight attention to these statistics, for they vary so little. An excellent fault. But the loss in labour seems to us to be more serious, however explained. Mr. Leopold Albu's speech at the Van Ryn meeting imparted some cheerfulness, for he took an optimistic view of the labour supply on the Rand. He stated that the Union Government was prepared to take additional steps for an improvement in the supply and would co-operate heartily with the agencies already at

work. That shortage of labour is serious on the Rand was brought home to speculators by the passing of the Nigel dividend and the explanation issued by the secretary of that company, stating that for several months the complement of 1800 to 2000 natives has been short by fully 1000. For this reason development work in the mine has been rendered impossible, and the manager found it necessary to hang-up 20 stamps and the tube-mill. The use of air-drills in stoping only lowered the grade and decreased the profit, so that October showed a £1500 decrease, followed by a further fall of over £3000 in November. As no improvement in the supply of natives was expected in December, or indeed until February, at the best, the directors decided not to declare a dividend.

The quietness of the South African market during the past year is reflected in the dividend of Rand Mines, essentially an investment company, which pays only 220%, as against 350% in 1909. This is equivalent to 6½% on the average price of the shares. The half-yearly dividend of 10%, absorbing £140,000, declared by the New Modderfontein, cheered the Kaffir market, for the interim dividend a year previous was only 5%. Another pleasant event was the starting, on December 20, of the City Deep mill; 50 stamps being then dropped, with the intention of increasing the number gradually, until 200 stamps, plus tube-mills, are fully employed.

The announcement that the Randfontein Central would absorb the Randfontein South was not well received, no obvious reason for this consolidation being given. The increase of ore reserves and the mere bigness of the new company does not entail larger profits than would be earned by the aggregate of the two mines. Decreased administration ex-

penses may be followed by saddling one management with more than it can do efficiently. It may appear likely that the differences in the mill equipment is the best reason, the new Central mill being given a larger capacity, by the addition of tube-mills, than is required by the output of that mine alone. However, the consolidation is deemed to have been announced at an inopportune moment and weakened the Kaffir market. Another amalgamation is that of the Princess Estate, Roodepoort Central Deep, West Roodepoort Deep, and the Norman Properties Syndicate. This will result in a company with a capital of £650,000 owning 680 claims.

Undoubtedly, during 1911 the production will decrease, and in some cases cease, at several mines on the Rand, for one or two of them are approaching the end of their 'life,' while others are being operated at a precarious profit. But the new year will see the starting of three new mills, at the Benoni, Randfontein Central, and City Deep, of which the two last together will crush 125,000 tons per month for a yield of about £340,000 or £4,000,000 per annum. This will constitute a notable addition to the Transvaal output. The Benoni, while a much smaller plant, will treat from 20,000 to 30,000 tons monthly, commencing in August. The ore in reserve is estimated at 462,355 tons, averaging 6·8 dwt. for a width of 42 inches.

RHODESIA.—The November statistics exhibited an encouraging improvement, the output being 1356 oz. more than in October, so that the total was the highest on record. The increase was chiefly due to the Globe & Phœnix, which produced 17,171 oz. from 5252 tons. The Giant also exhibited an advance, obtaining 4495 oz. from 10,320 tons. The number of productive mines is given as 160, or 13 less than in October. At the Giant no less than 73 ft. of ore, averaging 18 dwt. per ton, has been proved at the bottom of the winze, 60 ft. below the sixth level. This en-

courages the belief that the orebody, which is faulted by a dike, will be found on the seventh level, where exploratory work is now proceeding.

The Selukwe gives the brokers the exhilarating ups and downs beloved of those who look upon mining shares as mere counters for a gamble. Soon after the announcement that the mine was a failure, and would be let on tribute, a cablegram was received stating that a "new reef" had been struck, carrying "very heavily mineralized" ore, assaying 5 dwt. for 28 inches. This caused a 'spurt' in the share quotation, but such news does not mean much, for two feet of 5 dwt. ore at one spot does not constitute a profitable mine nor even the beginnings of one. The management ought to explain their cablegrams so that unjustifiable inferences may not be made. Since the above was written the reports from this mine indicate that the ore found on the No. 10 level is of no consequence and it is likely that the mine will now be let on tribute.

One of the most interesting financial events in 1910 was the flotation of the Shamva claims for £600,000 and the immediate rise of the £1 shares to £5½. At that time the mine was only a big prospect, and even now the work done is as yet too incomplete to warrant the talk of 26,000,000 tons in reserve. Such a quantity of ore cannot be 'proved' in a few months. The criticism may not interest those who look at the Shamva as an attractive gamble, but it may interest those who regard it as an investment. It appears to be an immense deposit and may make a splendid mine, but these possibilities have been already discounted. Meanwhile the ore is being tested in a 5-stamp mill, with a view to ascertaining the economical stoping-width.

The annual report of the Giant Mines does credit to the technical management for it shows that the working cost is 17s. 6d., or the same as the average of the Rand. Much depends upon the finding of the orebody at the

7th level and the proof of further persistence, despite the faulting.

WEST AFRICA.—We look for better results, that is, more dividends from this part of the world in 1911. According to official estimates the ten principal mines possess about 3,000,000 tons of proved ore, averaging 12 dwt. gold or 50s. per ton. This means a gross valuation of about £7,000,000. Allowing for an extraction of 85% and a cost of 30s. per ton, the total profit to be distributed during the next five years should be £1,500,000 to £2,000,000. The payment of dividends depends upon the proper organization of the labour-supply, the betterment of conditions of living, and harmonious action between all concerned, especially the mine managers and the Government of the Gold Coast. The cutting of 6 ft. of ore averaging 3 oz. per ton on the ninth level of the Ashanti mine is a splendid item of news to the Ashanti Goldfields company and to all interested in West Africa. The ninth level is at 810 ft. below the surface and in the deepest working.

The annual meetings of the Taquah and the Abosso mining companies have been postponed pending a joint inspection by Messrs. G. A. Stockfeld, Rudolf Recknagel, and S. R. Adams, all of whom will confer with the resident manager, Mr. J. W. Newbery. It is stated that the development of both mines continues to be entirely satisfactory.

Another important amalgamation is announced, the Prestea Block A absorbing the property of the Prestea Mines. In order to do this the capital of the first mentioned is to be increased from £850,000 to £1,150,000. At the Block A the mine developments continue to be satisfactory, the winze below the third level showing an average of over 3 oz. per ton, while the fifth level is opening up well. The resumption of milling at the Prestea Block A will help the market. The high assays reported from the Chujah and Dumassie claims, owned by the Himan Concessions, has helped

the West African Trust, which holds a controlling interest. At the Cinnamon Bippo the finding of the lode beyond the fault on the adit level is important, for the ore assays 11 dwt. for a width of 20 inches and may now continue for some distance.

Increased returns ought to be forthcoming from the Ancobra dredges, an experienced man from California having been engaged to re-organize the work of the four machines now in operation. The conditions are not easy, for floods and drift-wood have hampered the dredges, but a yield of half an ounce of gold per hour of actual work is promising. The enterprise is in good hands and ought to afford an interesting chapter in gold-dredging under difficulties.

Some of the Nigerian tin shares have risen on favourable news concerning the completion of the new wagon-road from the Baro-Kano railway to the Bauchi district. This road is said to be much preferable to the one in use and will tend to lessen the cost of transport.

AUSTRALASIA.—The year begins auspiciously with the settlement of the labour controversy at Broken Hill, an agreement for 4½ years having been made, on a conciliatory basis. At Kalgoorlie the wood-cutters are making trouble and the Golden Horse-Shoe has been forced to close down. Other mines may be affected, but it is believed that the Italians who have stopped work are without financial resources and are not likely to maintain a long strike.

The stopping of work at the Bullfinch, also on account of a labour strike, not a 'strike' of ore, had a bad effect, despite the rich stuff that is being bagged in the course of development. The details of work do not sound convincing, for the advance of drifts or deepening of prospect shafts appears to be slight. No fresh evidence is offered as regards continuity of the ore between the shafts or persistence in depth. That is a matter of vital interest. Of course rich ore can be, and is

being, bagged, for the mine is known to contain such material, but even the November output of 399 tons containing 5475 oz., worth £21,203, is nothing tremendous for a mine valued on the market at £1,500,000. Another Bullfinch company is advertised in London, while from Kalgoorlie comes the news that the manager of one of the new 'mines' has "absolutely condemned it," despite the favourable testimony of Mr. Doolette and others.

Favourable developments are reported from Broad Arrow, in Western Australia. Also from the Mount Margaret and Dundas gold-fields. Occasional rushes to localities in the Yilgarn district indicate that the Bullfinch discovery has stimulated prospecting. At the Sons of Gwalia the development work on the west lode continues to give excellent results, ore having been cut on the 13th level, showing a width of 10 ft. averaging 18 dwt. per ton. In the deeper workings of this mine no less than seven roughly parallel runs of ore have now been found.

CANADA.—Interest in Porcupine continues unabated. The coming of winter has frozen the trail and facilitated transport. Crowds of prospectors and adventurers are going to the goldfield. New discoveries are announced in exaggerated language and claims are held at fancy prices. Several London houses have taken options, but no large sums are involved, the idea being to watch developments and be ready to participate if further exploratory work proves that the ore persists in depth.

UNITED STATES.—A period of quiet is anticipated, after the recent period of liquidation. In 1910 a hundred stocks declined \$951,000,000 or 15% of their total par value. The anti-trust litigation and the impending tariff reductions are acting as brakes to speculation, but general conditions are healthy. During the current year the Curb market is likely to lose Chino, Miami, Ray Consolidated, and probably the Standard Oil and American

Tobacco. This will render this informal market unimportant.

COPPER.—The monthly statistics of the American Copper Producers' Association show that the export deliveries in December increased 9232 long tons, which is satisfactory, but the domestic deliveries decreased 7592 tons, which is most unsatisfactory. The increase of production, 1779 tons, was also a disagreeable surprise. Despite the friendly co-operation of the principal copper producers it is evident that they are unable to limit the output, while at the same time the obvious shrinkage in consumption threatens the market. The stocks of copper in America decreased 3731 tons in December, and are almost exactly equal to the surplus on hand two years ago, but 8810 tons less than they were twelve months ago. With a foreign visible supply of 105,600 tons, the total copper on hand amounts to 160,000 tons, as against 179,036 tons in July, 172,308 in January last, and 110,300 two years ago. This simply emphasizes the utter inability of the American group to curtail production.

MEXICO.—The result of the extraordinary meeting, at which the French majority asserted itself, was to take the management of the Mexico Mines of El Oro from 11 Cornhill, and it is now announced that the new secretary is Mr. Edmund Heisch, with offices at 120 Fenchurch Street. At the same time it is stated that Don Guillermo Landa y Escandon, the Governor of the City of Mexico, has joined the board of directors. This gentleman is a member of a distinguished Mexican family and chairman of the Dos Estrellas, another mining company operating at El Oro, and one whose shares were vigorously boosted in Paris during the past summer.

The old Palmarejo seems in a fair way of being made a success, after all sorts of vicissitudes. This will be due to skilful management and the application of cyanidation to the treatment of a silver ore, after it has been

shined. In the mine itself more ore has been uncovered, increasing the reserve to 200,000 tons, averaging 14 oz. silver and 2 dwt. gold.

Options given in Paris on blocks of Camp Bird shares have been freely exercised, and the French holding now amounts to between 125,000 and 150,000 shares. News from the mines is satisfactory; from the old mine in Colorado a net profit of \$800,000 is still available, while at Pachuca the Santa Gertrudis is showing well in depth. Development work is in progress on the 18th level. The new mill has been delayed in equipment by the slow delivery of the agitator-tanks, and is not expected to be ready until May.

INDIA.—The production of gold in India keeps remarkably even, and the yearly and monthly figures show little variation. The output during 1910 is estimated to be worth £2,104,000, as compared with £2,083,900 in 1909 and £2,158,700 in 1908. How the Mysore mine overshadows the others may be gauged by the fact that its yield for 1910 accounts for 40% of the whole output. Champion Reef was responsible for approximately 20%, and Ooregum and Nundydroog for about 16% each. The remainder came from the Balaghat, Hutti Nizam, and North Anantapur. The chief features of the year in connection with Indian gold mining have been the failure of the Dharwar district, the encouraging developments at Anantapur, and the slight but steady improvement in the grade of the Champion Reef.

RUSSIA.—The Siberian group is doing well. At Kyshtim a notable technical success is being made in smelting a low-grade massive copper-bearing pyrite. One-half of the smelter has been started, and the other half will be at work in a few days. The total capacity is 1000 tons of ore per day. The plant consists of two 4 by 25 ft. water-jacketed blast-furnaces, the blast being furnished by two Parsons turbo-blowers. The basis of the operation is pyritic smelting, and only 1% of

coke is required. For the week ending December 4, the charge averaged 0.99% coke, 78% ore, with 21% quartz and limestone. The ore contains 3% copper and 47% sulphur. Basic lined converters are being added.

At the Atbasar the work of underground development continues to be highly satisfactory, high-grade ore, ranging from 12 to 14% copper, being exposed by shafts and drifts at a shallow depth, from 40 to 170 ft. below the surface. The coal deposit, 60 miles distant, is being explored and a seam 5½ ft. thick has been cut at a depth of 77 ft. This coal is already being burned under boilers and will undoubtedly facilitate economic smelting operations. Reverberatory furnaces will probably be constructed for the treatment of the ore, in which the copper exists as bornite and chalcocite within a matrix of sandstone.

The Spassky is showing the benefit of the re-organization effected in the last two years. The output is increasing steadily and the development underground keeps pace with it. Systematic extraction of ore is proceeding above the 490 ft. level. During the current month the third blast-furnace will be 'blown in' and an additional converter started.

The Orsk Goldfields has made another appeal for capital, the guarantee of the Siberian Proprietary ensuring the success of the issue of 100,000 new shares. Thus ample money is now available for completing the work started by Mr. C. W. Purington on the Kolchan property. Tentative operations and further sampling by Mr. D'Arcy Weatherbe tend to confirm previous estimates of the richness of this alluvial deposit.

KOREA.—The Suan mine is doing well. The capacity of the mill has been doubled, to 40 stamps, and a steel pipe-line two miles long has been laid down, all the cost being met out of current revenue. Dividends for the year aggregate 25%. At Kapsan the lode has been cut at 191 ft., showing 18% copper ore for a width of 15 ft.

STATISTICS

STOCKS OF COPPER IN ENGLAND AND FRANCE

	Oct. 31 Tons	Nov. 30 Tons	Dec. 31 Tons
In England	71,280	67,327	66,917
In France	6,592	6,423	6,080
Afloat from Chile	3,250	4,250	3,600
Afloat from Australia	7,300	8,250	7,200
Total	88,422	86,250	83,797
In Rotterdam			6,800
In Hamburg, estimated			15,000

AMERICAN COPPER PRODUCERS' ASSOCIATION
In Tons of Gold

	Production	Deliveries			Stocks at end of month
		Domestic	Foreign	Total	
September	53,357	28,795	33,529	62,324	66,496
October	56,459	30,274	30,441	60,715	61,170
November	53,282	27,143	33,100	57,243	58,209
December	55,062	14,400	34,444	58,844	54,479

December, 1909					63,288
Year 1910	648,268	334,563	322,514	657,077	

SALE OF TIN CONCENTRATE AT REDRUTH

DATE	Tons	Value	Average
November 1 st	240½	£23,557	£97 18 6
" 16	257½	£23,316	£92 6 6
December 1 st	257½	£27,506	£106 16
" 28	18½	£24,127	£107 19 0
Year 1910	6,102½	£619,000	£101 9 6

PRODUCTION OF GOLD IN THE TRANSVAAL.

MONTH.	Rand	Else- where	Total	Value
1910	Oz.	Oz.	Oz.	£
January	579,743	21,625	601,368	2,554,451
February	550,422	25,200	575,622	2,445,088
March	581,899	25,220	607,119	2,578,877
April	594,339	24,706	619,045	2,629,535
May	606,724	27,446	634,170	2,693,785
June	598,339	26,842	625,181	2,655,602
July	610,664	28,050	638,714	2,713,083
August	623,129	26,140	649,269	2,757,919
September	621,311	25,588	646,899	2,747,853
October	627,445	25,702	653,147	2,774,390
November	617,905	24,686	642,591	2,774,390
December	616,668	24,327	640,995	2,722,775
Totals, 1910	7,228,588	305,532	7,534,120	32,002,912

COST AND PROFIT ON THE RAND

MONTH.	Tons	Yield per ton	Costs per ton	Profit per ton	Total profit
1910		s. d.	s. d.	s. d.	£
January	1,754,140	27 7	17 0	10 7	924,275
February	1,614,730	28 5	17 6	10 10	874,746
March	1,767,059	27 6	17 1	10 4	913,759
April	1,763,104	28 1	17 6	10 7	927,244
May	1,785,821	28 1	17 6	10 9	958,347
June	1,766,737	28 1	17 6	10 5	921,136
July	1,814,686	28 1	17 8	10 1	937,456
August	1,834,105	28 3	17 8	10 6	961,304
September	1,835,647	28 3	17 11	10 4	942,330
October	1,868,718	28 0	17 9	10 9	952,161
November	1,800,371	28 6	18 0	10 7	951,773

NATIVES EMPLOYED IN THE TRANSVAAL MINES.

MONTH.	Gold mines	Coal mines	Diamond mines	Total
October 31	180,103	8,528	8,068	196,699
November 31	178,027	8,367	8,362	194,756
December 31	178,602	8,354	9,939	196,895

PRODUCTION OF GOLD IN RHODESIA.

MONTH.	1908	1909	1910
	£	£	£
January	199,388	204,666	227,511
February	191,635	192,497	203,888
March	200,615	202,157	228,385
April	212,935	222,700	228,213
May	223,867	225,032	234,888
June	224,920	217,600	214,709
July	228,151	225,234	195,233
August	230,792	228,296	191,423
September	204,262	213,249	178,950
October	205,466	222,653	234,928
November	196,668	236,307	240,573
December	217,316	233,397	
Totals	2,526,007	2,623,788	

PRODUCTION OF GOLD IN WEST AFRICA.

MONTH.	1910		1909		1908	
	Oz.	Value	Oz.	Value	Oz.	Value
		£		£		£
January	17,357	70,699	22,817	91,112	24,844	98,808
February	16,976	68,469	21,403	86,210	25,354	101,813
March	17,627	71,954	23,186	93,556	26,726	106,243
April	16,363	67,069	21,491	88,071	25,108	100,353
May	16,590	68,355	25,104	100,056	24,227	97,091
June	17,194	70,988	17,340	70,561	23,360	92,737
July	15,564	58,551	17,331	70,523	24,587	97,829
August	13,921	57,713	17,766	71,614	25,195	100,629
September	11,497	47,746	18,125	72,963	25,123	99,689
October	13,341	55,046	15,957	65,813	23,781	94,674
November	14,021	57,658	17,882	73,824	24,437	98,214
December			17,570	71,332	24,624	98,262
			235,972	955,635	297,366	1,186,342

PRODUCTION OF GOLD IN WESTERN AUSTRALIA.

MONTH.	Export oz.	Mint oz.	Total oz.	Total value
January	34,327	97,960	132,287	561,917
February	35,169	87,947	123,116	522,959
March	26,515	100,479	126,994	539,433
April	30,240	107,524	137,764	585,181
May	29,244	100,165	129,409	549,696
June	35,294	97,207	132,501	562,825
July	31,986	101,132	133,118	565,445
August	36,028	100,590	136,618	580,313
September	34,787	110,131	144,918	615,569
October	21,911	101,183	123,094	522,867
November	34,067	92,554	126,621	537,489
December	13,928	112,984	126,912	539,348
Totals, 1910	363,496	1,209,856	1,573,352	6,682,042

OTHER AUSTRALASIAN GOLD PRODUCTION

	December	1910	1909
	£	£	£
Queensland	186,100	1,840,337	1,916,468
New South Wales	44,836	803,727	869,546
New Zealand	150,501	1,896,322	2,006,910
Victoria	125,400	2,186,000	2,897,340

GOLD OUTPUT OF INDIA.

MONTH.	1909	1910	MONTH.	1909	1910
	£	£		£	£
Jan	173,555	174,314	Jul	172,552	175,523
Feb	153,542	170,725	Aug	173,318	175,176
Mar	170,106	176,231	Sep	173,279	175,527
Apr	170,578	175,539	Oct	173,496	175,719
May	172,156	175,387	Nov	176,027	175,604
Jun	171,585	174,923	Dec	203,703	175,176
			Totals	2,083,901	2,104,858

EDITORIAL

THE HONOURS List issued on New Year's Day is interesting, but not nearly as interesting as would be the list of those who declined honours. The gentlemen most to be congratulated are the two dusky ones in India whose salutes were increased from 17 to 19 guns, and from 9 to 11 guns, respectively. They must feel proud.

STATISTICS are valuable, if accurate and timely. They measure accomplishment and indicate tendencies. To be useful they must be fresh, for their vitality is killed by cold storage. We devote one page regularly to current statistical data and we hope that the concentrated information on this page will prove serviceable to our readers.

MUCH of the material collected by the Surveys and other Government departments becomes mildewed before it sees daylight. For example, the Imperial Institute has an arrangement with the Colonial office whereby it conducts mineral exploration in various Crown protectorates, such as Ceylon, Nigeria, and East Africa. This information, in part economic and in part scientific, is gathered, but it is not distributed with any kind of promptitude. A rule obtains forbidding the Survey officers to divulge data on economic matters until the final reports are published by the Institute, although no such embargo is placed on scientific subjects. Obviously the publication of scientific information could be delayed with less loss to its usefulness than the economic data, which must be timely to be of any service. Delays are unconscionable. The results of expeditions sent out two years ago have not yet been published. When issued they will have an academic interest only and will only be of use as records.

GREAT BRITAIN'S capital investments amount to a stupendous total. According to Mr. George Paish, of *The Statist*, the capital invested in various countries amounts now to £3,191,836,000, of which £1,637,684,000 has been supplied to foreign countries; and of the latter amount the United States has received 42%. Even these colossal figures do not include private ventures. The total of our investments in other lands is estimated to be fully £3,500,000,000. Of this about £250,000,000 is invested in mines, one-half of it in South Africa, £44,000,000 in Australasia, and £22,000,000 in the United States of America.

FROM the Geological Survey of Western Australia we have received a Christmas card depicting a shaft on the Bullfinch mine, surrounded by sacks, presumably filled with rich ore. On the rim of the photograph is perched a bullfinch, with his weather eye open, while on a branch below him crouches a wild cat, greedily regarding a possible dinner in the shape of the little innocent bird. Our scientific friends on the Geological Survey evidently possess a sense of humour. We thank them for the allegory, and venture to interpret it further. Bullfinches are nice little birds, but, if they are so fat and careless as to be caught by a wild cat they may lose their identity. Moral: Innocent bullfinches should avoid the company of rapacious wild cats, for fear of malevolent assimilation.

J. P. MORGAN & CO. is a financial house so influential in American and international affairs that any change in the composition of the firm is of general interest. Hence the retirement of Mr. George W. Perkins came as a surprise, for he was deemed a likely

successor to Mr. J. Pierpoint Morgan in the leadership of the company. The result is that Mr. J. P. Morgan, junior, the son of the chief, now becomes his logical successor and the inheritor of a financial power that may exert a beneficent influence in regulating the eccentricities of speculation on Wall Street. For this Mr. Perkins was not well adapted, being a man of exuberant ambition and too closely associated with the unconventional methods and eventual scandals of the big insurance companies to inspire the confidence of the cautious investor. On the other hand Mr. "Jack" Morgan has won good opinions during recent years, both from his associates and employees, so that his promotion as under-study to his celebrated father has been received with keen pleasure on both sides of the Atlantic.

SCARCITY of labour is still a vital problem in South Africa. It appears that the efforts of recruiting agencies, other than the Witwatersrand Native Labour Association, has been to create competition and the payment of large sums in advance. This excess is being regulated by the Government, which is taking a helpful interest in the matter. The chief trouble is due to the migratory character of the natives. It has been stated that while an industrial enterprise in England requiring 1000 unskilled labourers, after making allowance for sickness, could keep going with 1100 men, a mine in South Africa, after a similar allowance for sickness, would probably carry 3000 men on its books during the year. Thus, other things being equal, the supply has to be treble that of the number actually employed.

PARAGRAPHS have appeared in the daily papers announcing that a new mineral has been discovered in Almeria, Spain, and that the deposit is said to yield large quantities of alumina and sulphate of soda by simple

calcining. The mineral is named Calafatite, after its discoverer. The newspaper reports employ the usual glowing phrases; they prophesy ruin to the German sulphate of soda manufacturers and announce that an American firm has offered to purchase 60,000 tons per year. Presumably the mineral is similar to hauynite or noselite, and belongs to the sodalite group that contains variants of nephelinite, one of the felspathoids. Nephelinite is a sodium aluminium silicate, and in noselite some of the aluminium exists as sulphate. Leucite is another member of the group containing more potassium than sodium. They have been known for many years to occur in notable quantities in igneous rocks in Italy and the rocks have from time to time been exploited for aluminium and alkali compounds. The basis of the reaction employed is digestion in acid, which removes the silica in gelatinous form. The importance of the new discovery in Spain is probably exaggerated, but as the report contains no mis-statement of scientific fact, we await practical details with interest.

TWELVE MONTHS ago we commented at great length on the affairs of the Tanganyika Concessions and criticized the technical features of this big enterprise. After another twelve months we find no reason for changing the views then expressed. No further information is available and no results are yet forthcoming. The railway has been extended to the Star of the Congo mine and a good deal of machinery is on the ground. It is stated that smelting operations on a large scale will commence in April. The optimistic assurances of an enormous output of copper were repeated at the recent annual meeting and from "unlimited" supplies of ore the company is to make a production at first of 1000 tons per month, then 2500 tons, and finally 4000 tons per month, or 200,000 tons of copper per annum. We repeat that when a reserve of ore is "unlimited" it has not

been carefully measured, that to apply a new metallurgical process is to increase the factor of uncertainty, that to deliver copper at a cost of £32 per ton from Central Africa is improbable, although more likely than the cost of £25 quoted last year, and finally that the ratio of expert technical advice to financial responsibility is in the case of the Tanganyika Concessions quite disproportionate. For the present it is worth noting that if the output of copper from the Lake Superior mines is to be duplicated as to amount by the mines near Lake Tanganyika, then the price of copper ought to be seriously depressed. Either Mr. Williams's optimism is severely discounted or the metal market is curiously insensitive.

AMONG the incidents at the recent meeting of the Mexico Mines company was Sir Clarendon Hyde's retort to Mr. R. T. Bayliss on the subject of Lord Cowdray's sanguine views regarding the prospects of the mine, in which he is a large shareholder. Under his former name as Sir Weetman Pearson this distinguished engineer was credited with exceptional sagacity and his promotion to the House of Lords is not supposed to have placed him under any handicap in that regard, therefore Sir Clarendon Hyde easily raised a laugh when he said that the epithet of "childlike" was new as applied to Lord Cowdray. And yet those who have had wide experience in business affairs can easily quote examples of men habitually cautious and constitutionally careful who appear to fling all doubt to the winds when once embarked in a mining speculation. Bankers, railway directors, merchants, architects, great lawyers, and great engineers, have contributed plenty of examples of unreasonable optimism and childlike confidence in the profits of mining operations. It is quite conceivable that a sagacious man like Lord Cowdray may hold wholly erroneous views as to the prospects of a mine in Mexico, for it cannot be emphasized too strongly that a civil

engineer is no better judge of a mine than a mining engineer is an appraiser of a railway system. *Chacun son metier et les vaches seront bien gardees.*

IT IS KNOWN that in the Pleistocene period much of the northern hemisphere was covered with ice, and that parts of Europe now mild and fertile were then frost bound. In other words, the climate was much colder than at the present day. Why should there have been this interval of coldness and then an increase in mean temperature? Probably the principle of 'recalcescence' has been already suggested, though we do not remember to have seen it so applied. At certain defined points the fall in the temperature of cooling bodies pauses and a slight rise ensues before the fall continues once more. Steel has three such points at 1500°, 1350°, and 1250°F, respectively, and the curve of cooling shows hollows followed by small crests. During the Ice Age the earth may have occupied a hollow of this nature, and we may now be living in a period of recalcescence. This theory is further strengthened by the evidence which shows that the Ice Age more probably consisted of a series of cold periods instead of only one uninterrupted era of geological time. We put this suggestion forward and hope that some of our geologist and physicist friends will discuss it.

The New Year.

It is not the custom of this Magazine to publish a review of the year, for each issue contains a summary of events in the mining world. The past is irrevocable; let it go; let us face the future with, at least, the resolve not to repeat our mistakes. The man who never made a mistake never made anything; the man who makes the same mistake twice is a fool. Even the youngest of us is not infallible, and even the oldest of us is not without hope. *Allons!* The Coronation year is before us; may it crown high purpose with

achievement, honesty with success, and hard work with profit wherever a pick is put into the ground. Men come and go, but mining remains—a great industry, requiring a wise combination of money and muscle, confidence and judgment, energy and caution. By the aid of these, and a little more money, it is possible to turn rock into profitable ore, to change a hole in the ground into a mine, and to make even shareholders grateful.

Putting generalities aside, we expect 1911 to throw light on many problems not yet solved. Time is a great solver of riddles. For instance, before this year has passed we ought to know definitely whether scarcity of labour is to be so chronic in South Africa as to cripple development in the Transvaal and Rhodesia. We are warranted in hoping that a successful stope-drill will at last be developed, so as to render labour more efficient. The labour problem confronts other mining regions. Is the lack of workmen to be the mark of this period of worldwide industrial expansion or is it only the manifestation of local conditions that will change? The ancient world went through a similar experience and solved it by importing slaves; the Rand imitated the process to the extent of indenturing coolies. The experiment economically was a great success, but sentimentally it was voted a blot on the national escutcheon. The transfer of the controversy to the political arena prevented unprejudiced enquiry, and it is likely that in some form the question of coolie labour will arise again, if meanwhile an adequate supply is not forthcoming elsewhere. That is one of the queries to be answered in 1911. Another is the inclusion of Rhodesia in the Union of South Africa. Incidentally, we ought to know within the twelve months whether the great Tanganyika enterprise is to depress the price of copper by a prolific production or only depress the shareholders by a magnificent fiasco. *Nous verrons.* We are told that the next boom is to be in Rhodesia; undoubtedly

there are the mines and the men to accomplish such a result. The next twelve months will indicate whether the Shamva agglomerate is to make one of the big gold mines of the world, whether the Giant orebody is a 'reef' or a snag, whether the antimonial gold ore in the Globe & Phoenix has been made docile to treatment, and whether Sir Abe Bailey did wisely in transferring his unbounded financial energies from the Rand to Rhodesia. In West Africa similar problems await solution: will a supply of labour be forthcoming from the northern territories, will the Government aid the mining companies, will high costs be so lowered as to facilitate dividends, or will tin mining on the Nigerian plateau prove more profitable than digging for gold in the Jungle? In Mexico many matters ought to be settled; the most important that may arise is the question whether the Government is sufficiently strong to survive the demise of the aged President or whether the succession can be so established as to prevent disorder when the hour of crisis arrives. We shall probably know before the end of 1911 whether Lord Cowdray or Mr. Bayliss is correct in estimating the earning capacity of the Mexico Mines of El Oro. The future of the new oil industry on the Gulf coast should be made clear. In the United States the schemes of the big copper operators should mature either into a merger or diverge finally into unrestrained production. The Calumet & Hecla holdings will be consolidated into one big company of extraordinary strength and stability. Will the Guggenheims continue to receive aid from J. P. Morgan & Co., or will Messrs. Cole and Ryan, supported by the Standard Oil clique, get the best of them in smelter competition? In South America the Cerro de Pasco enterprise ought to come to fruition and the Ferrobamba will have been diagnosed by competent engineers. We shall see whether the application of dredges is to be extended and particularly whether the Oroville Dredging company is to be re-

suscitated by its enterprise in Colombia. In Australasia the Waihi mystery will be cleared and the future of that mine will be ascertained, not by geological disquisition, but by exploratory work on the lode, which has proved so disappointing on the present lowest level. At Broken Hill the battle of the concentration processes will be waged to a finish and the big dumps will dwindle so as to necessitate consolidations or fresh supplies of material from underground. The Great Cobar and Great Fitzroy copper mines, the Tasmania gold mine, and the Mount Bischoff tin mine are at a stage of re-animation that presages healthy recovery. We do not like obituaries. In Western Australia it will be demonstrated whether the rich ore in the Bullfinch goes deeper than the jasperoid ironstone, and at Kalgoorlie the fates will decide whether Mr. Kuss or Mr. Sutherland has correctly estimated the ore reserve in the Golden Horse-Shoe, and whether Messrs. Liveing and Roberts were only timid or properly cautious in their appraisal of the resources in the Associated mine. In Asia the Siberian copper group should show what they can do, the Orsk Goldfields will still be in the incubator, and the Lena will be so productive as to arouse Russian jealousy. Not next year, but possibly before the Greek kalends, this and other English companies operating in Russia will shed their *zlotniks*, *funts*, and *sajenes*, in favour of plain units understood by their shareholders.

In metallurgy the Moore and Butters litigation will have been settled, and the legal decision may be followed by benevolent assimilation. The Murex process will have had a fair trial. The oil processes will have received a further baptism from the courts of law. The advantage of rigidity in stamp-mill construction will have been tested by the City Deep. The Nissen stamp will be accepted or rejected on the Rand. Electric smelting will have been applied to iron scrap and magnetite ore in the

Transvaal. The results of applying a new method of magnetic separation to the Dunderland deposit, in Norway, will be known, and some 50,000,000 tons of ore will be commercially valuable or only geologically interesting. In fact, 1911 is so full of possibilities that we look forward to making *The Mining Magazine* more interesting to our readers than even the Battle of Stepney or the German naval scare.

The Colliery Disaster.

Christmas was saddened by several fatalities, the worst of which was the underground explosion that killed 350 men in the Yard mine, of the Hulton Park colliery, near Bolton, in Lancashire. This was regarded as one of the "safest"—that is, least dangerous—collieries in England, for, although the workings were known to be 'gassy' and 'dusty,' the disuse of electric cables and the abstention from shot-firing were deemed enough to ensure immunity from explosions. Safety-lamps, of course, were in general use, a naked light being deadly. And yet the cause of the explosion that hurled three hundred men into one vast tomb was probably the carelessness of one of them, who either had a defective lamp or struck a match to light a pipe. It is from such simple causes that big mining disasters usually spring, the criminal carelessness of one man involving not his death only but that of scores of his mates. The atmospheric pressure was so great at the time as to render a 'fiery' mine particularly dangerous and it is said that earth tremors may have precipitated an unusual escape of gas from the coal seam into the mine, but these facts need have entailed no mortality if every miner had taken the usual precautions. One of them did not, so this Pretoria Pit disaster will go down as the worst since 1866, when 388 men were killed in the Oaks colliery, near Barnsley. Indeed, the statistical information is depressing. Only last May the Whitehaven fire cost 136 lives. The reports of the Chief Inspector of Mines show that from 1872, when

the Mines Regulation Act was passed, to 1898 the death-rate tended to diminish, but during the last 12 years the rate has increased; in other words, coal mining in Great Britain has become more dangerous. In 1899 each million tons of coal cost 4 lives; in 1909 each million tons of coal entailed the loss of $5\frac{1}{2}$ lives. Occasional accidents may be explained by fortuitous happenings, but a steady tendency in the wrong direction proves that even experience and science have failed to overcome the unfavourable conditions that surround the occupation of the coal miner. Undoubtedly the intensified exploitation of coal, the use of electricity underground, and the generally increased rapidity of extraction by means of machine-cutters, have placed the workers at a disadvantage in the contest with adverse natural conditions. In 1906 a Royal Commission was appointed to enquire into questions relating to the health and safety of miners, and this Commission, in its desire to ascertain the cause of coal-dust explosions, referred the matter to a special committee, which reported that it had been proved by experiments properly verified that coal-dust "in the complete absence of fire-damp is explosive when raised as a cloud in the air and ignited." It was found that explosive action was lessened along the haulage-ways where stone (rock)-dust prevailed, and it was then ascertained that the sprinkling of stone-dust on the roof, sides, and floor of the workings in which coal-dust accumulated would mitigate the danger, because the incombustibility of the stone-dust retarded the explosion of the combustible coal. It appears that in this way coal-dust may be rendered inert and innocuous. This investigation is still proceeding and promises to be of the greatest value. In the meanwhile we may congratulate ourselves on the improvement in rescue apparatus and in the use of it. At Whitehaven the rescue apparatus was not ready for use until 27 hours after the fire started; at the Yard mine the rescuers were

organized and the necessary oxygen respiratory apparatus was available forthwith. Thus many men in the adjoining Ardley workings were extricated and the search amid the ruins of the Yard mine itself was rendered immediately possible. This work was performed with conspicuous bravery and despatch. Peace hath her heroes no less renowned than war. The sad episode coming at a time of good cheer has impressed even the most casual with an appreciation of the fact that to fight after-damp is as courageous as to fight Zulus, and that the army of workers underground is at least as essential a part of our complex civilization as the battalions that march to fife and drum on the sunlit surface.

Circular Shafts.

The adoption of a shaft of circular cross-section at the Modderfontein B mine in the Witwatersrand draws attention once more to the relative advantages of circular and rectangular shafts. It is seldom that the circular form is used in metal mining, because almost invariably there is no hydrostatic pressure in overlying watery strata, and shafts of this kind are usually associated with coal mining. A circular lining is capable of withstanding the inward pressure of water or of loose ground better than one of any other shape. The chief disadvantage, which forms the staple argument against circular shafts among metal miners, is that they involve a greater amount of excavation than is required in rectangular shafts in order to obtain the same amount of haulage room, because there are segments of the cross-section that cannot be utilized to advantage. Naturally, timbering is required for a rectangular shaft; on the other hand, such a shape is inapplicable to concrete, brick, or stone lining, because the walls afford no resistance to inward pressure of water or loose ground. Many proposals are brought forward from time to time recommending the use of an elliptical cross-section, or a rectangular cross-section

with sides that are arcs of circles of greater diameter than the shaft. These are a sort of compromise to secure support against inward pressure and to reduce the amount of wasted space. In addition to the greater amount of excavation required with a circular cross-section, the cost is also increased by the extra expense in connection with the brick-work, mortar, and grouting for the back, as well as the labour of building the lining. Consequently a brick-lined circular shaft would never be used in preference to a rectangular timbered shaft in average safe ground except for a special reason. The chief and practically the only valid reason is that large amounts of ore are to be rapidly hauled from great depth for at least ten years. The ore reserves must warrant the assumption that the mine will have a long life at depth. Granting these premises, the advantages of the brick-lined shaft are clear. In the first place, all anxiety about the life of the timber is at an end; no rotting and repairs; no risk of fire. A shaft sunk to connect deep workings is sure to become the natural up-cast and the decay of timbering caused by the hot and foul air would be a serious matter. The speed of hauling can safely be greater in a brick-lined than in a timber-lined shaft, because the guides and frame-work can be kept aligned more exactly. As regards the vacant unused spaces of the circular shaft, there are good reasons for considering that they would not necessarily be wasted. For instance, they would provide the necessary extra ventilation required in mines with extensive and deep workings; in order to make it possible to mine at great depth, where the rock is hot, a liberal circulation of air will always be required. Again, with rapid hauling a clearance is necessary; otherwise the close fit of the skip and the sides of the compartments causes much air-resistance. The vacant spaces would also be available for electric wires and air-pipes. Altogether many questions must be considered, and the acqui-

sition of experience in practice is a costly matter.

So far as we know the first modern deep shaft through hard ground to be built with a circular cross-section was that at Dolcoath. This design was adopted by the advice of a South Wales firm of coal-mining engineers, whose services had been requisitioned for the purpose by Mr. Basset, the 'lord' of the mine. That a brick-lined circular shaft should be sunk through the hardest of slate and granite has for years been the cause of wonderment among many people, not excluding ourselves. The next one to be sunk was the Edgar shaft at the Mysore mine, which was soon followed by another at the Champion Reef. At these two mines the brick-lining was not cheap, for much of the brick had to be brought by rail from Malabar; besides, the work was new, and as the local labour was not of high efficiency, skilled bricklayers had to be imported. Probably the best method of lining will be to use concrete blocks made to size at the surface, and after being lowered to their position joined with hydraulic cement and backed with cement grouting. We consider that the exponents of circular brick-lined shafts have a good case when they urge their adoption at very deep mines with large ore reserves; and that the possession of such a shaft will increase the limit of depth at which profitable mining may be conducted.

Council of the Institution.

Not long ago we ventured to criticize the manner of election and the composition of the Council or governing body of the Institution of Mining and Metallurgy. We understand that the subject has been discussed by the Council, but without any apparent result. The balloting list now being issued to members bears 28 names, from which 24 are to be selected. In addition to these 24, the Council includes a president, 6 vice-presidents, and 11 ex-presidents, so that the total is 42. This is

excessive, to put it mildly. In course of time, if, as we hope, all the ex-presidents survive to a venerable age, the Council will be dominated by an immovable phalanx of gentlemen that have passed the chair. Again, the vice-presidents are not elected as members of the Council; they are selected by the Council itself. It is true the vice-presidents are usually men who have previously served on the Council, but their names are not on the balloting list, although from among them the new president is chosen. Thus out of the 42 members of the Council no less than 18 are not submitted to the ballot. Indeed, it is not too much to say that the ex-officio members are usually in control. They are veterans ordinarily resident in London and able to attend the Council meetings, while the elected members are among the active nomads of the profession, busy inspecting mines in the waste places of the earth. We do not object to the greater authority of the veterans who are ex-presidents and vice-presidents, but we lay stress upon the anomaly that they are not on the annual balloting list, that is, they are not elected, but ex-officio members of Council. The whole arrangement is defective. In the first place the number is too large for efficiency, for it turns the Council at times into a sort of debating society, the decisions reached being disproportionate to the amount of talking. In these days everything is done by small committees and while we are aware that important questions coming before the Council are usually referred to special committees, we believe that it could be as well, or better, done by a smaller number. However, beyond the unwieldy size of the Council is the more important point that its composition is fixed. It varies so slightly as to be practically the same from year to year. On the latest balloting list we find only four fresh names, and they are of men who have not, recently at least, taken any part in the meetings. Moreover, among the fixtures we see the names of fully

half a dozen men who never attend the meetings and rarely appear even at the Council table. Election—or selection, to be precise—for the Council should be based not on fictitious prominence but on a lively and useful interest in the affairs of the Institution, as evinced by attendance at, and participation in, the monthly general meetings. The candidates should, if possible, be representative of others besides themselves and be able to express views which, in the aggregate, reflect the opinions of the general body of the Institution. Further, the interest of the members at large would be stimulated by a real election and a real choice of the governing body, leaving it to the Council to select the president and the vice-presidents, all of whom should, of course, be chosen by the members as their representatives on the Council before they become eligible for office. That is the essence of representative administration. It is the basis of parliamentary government. Again, in regard to the 'corresponding members of Council,' of whom there are 45, the number is excessive, and as several of them may at any one time happen to be in London they are apt to intensify the inconclusiveness of the deliberations. Obviously it is useful for the officers of the society to have responsible foreign correspondents to whom they can turn for information concerning candidates for membership, and so forth, but all such aid can be obtained without covering two pages of every bulletin with the names of people. The entire subject is one that calls for discussion and we hope that members will use this Magazine as a medium for expressing their views, for the benefit of the Institution and the advancement of the profession.

By way of supplementing destructive criticism with constructive ideas, we might suggest that the Council consist of 12 men, one third to be elected each year for a term of three years. The balloting list should present a dozen or even twenty names, from which four would be chosen at the annual election for

members of Council. Next, the vice-presidents should be selected by the Council from among its elected members. Four vice-presidents should be enough, two being chosen each year for a term of two years. Finally, the president should be taken from among the vice-presidents, as is done now. As regards ex-presidents, we suggest that each president on retiring from the chair should be an ex-officio member of the Council for one year. After that he would become eligible for election to the Council like any other member, and in due course he might even be re-elected president after a reasonable interval. On serving his term of three years on the Council, or of four years in the case of a president elected in his third year, each individual should be ineligible for office for one year. This would ensure a reasonable distribution of responsibility and honour; it would render the governing body truly representative, and would greatly tend to increase the interest of the general membership in the administration of the Institution.

Mexico Mines of El Oro.

The extraordinary general meeting of December 16 proved to be an event of unusual interest. Before discussing the points involved, we shall briefly state the facts of the case: The company was organized in 1904 by the Exploration Company, on the introduction of Lord Cowdray, to acquire a mine adjoining the Esperanza, at El Oro, Mexico. The capital was £180,000, all of which represented money actually spent or to be spent on the development and equipment of the mine. There was no 'plunder.' Every share represented the actual expenditure of a sovereign. It was one of the cleanest bits of mining finance ever done in the City of London. And it proved highly successful. Up to date no less than £315,000 has been paid in dividends, so that the shareholders have received a return of their capital plus 12% per annum. The management has been in the hands of the Exploration Company,

at 11 Cornhill, and more especially of Mr. R. T. Bayliss, who, as chairman, has guided the general policy. At the mine Mr. R. M. Raymond, with Messrs. Fergus Allan and Alfred F. Main, has directed the technical work. No one has questioned the excellence of the administration either at the mine or in London. The whole affair was regarded until recently as a feather in the cap of the Exploration Company, of Mr. Bayliss personally, and of honest mining generally. Mr. Bayliss himself said: "It is the best little mine I have ever had anything to do with." And yet in the end—as he confesses—it caused him more annoyance than any enterprise with which he has been connected in 25 years. How did this happen? Various versions of the story have been told. We shall tell it without prejudice, except such sympathy as is due to a man of honourable repute and approved capacity, and we deem it well to state the case at length not only because of its personal and financial bearings, but because it involves the general principles underlying the administration of mining companies.

As readers of this Magazine are aware, a lively interest has lately been taken by the French in Mexican business, such as banks, oil companies, and mines. Their participation has included speculation, on a large scale, in the shares of the Dos Estrellas and Mexico mines, both of which are in the El Oro district. Owing to the French purchases of Mexico shares the price was lifted last year from £6 at the beginning of January to £9½ in June. Since the annual meeting on September 20 the shares have been depressed from 9½ to 7½, recovering recently to 8. These fluctuations have been credited mainly to the dealings at Paris. Shares in several mines were undoubtedly 'kited' on that market, and among those unduly elevated was Mexico Mines of El Oro. On enquiry at 11 Cornhill we were informed months ago that there was no news from the mine to explain the rise and that it was due to causes having no direct relation to the condition of the mine.

In our April issue, on page 243, we deprecated the booming of the Mexico shares, and in later issues we referred to the excitement that appeared to possess French speculators. In July we commended the promptitude with which Mr. Raymond's interim report of June 22 was issued to the Press and to shareholders. That report warned the proprietors that the main lode had split at the sixth level and foreshadowed a decline in the grade of the output. At the annual meeting on September 20 Mr. Bayliss quoted Mr. Main as saying that the average tenour of the reserve would show a decrease, and he added his own "note of warning," saying that he considered it his duty "to bring the possibility of some reduction in profits at the end of this year prominently" to the notice of shareholders. The year was the 12 months ending on June 30, 1911. Some misunderstanding was caused, it is claimed by Mr. Bayliss's critics, by supposing that he referred to the calendar, not the financial period. At the annual meeting the transfer of a large block of shares to French holders was recognized by the election of Mr. H. Higgins as a director. Ten days earlier, in the annual report of the El Oro Mining & Railway Co., the usual reference was made to its holding of Mexico shares and it was stated that all of them had been sold. On November 26 a requisition was served by the French shareholders demanding that an extraordinary meeting be convened for the purpose of dismissing Messrs. R. T. Bayliss and J. H. M. Shaw from the board of directors, and for moving the office away from 11 Cornhill. In the December issue of this Magazine we commented upon the manner in which this request was made, deferring further comment regarding the subject of controversy until the facts had been ventilated. This was done effectively at the meeting of December 16, to which we now come. At this meeting the complaint of the French shareholders was presented by a well known barrister, Mr. D. Stewart Smith. He claimed to

speak for the holders of 88,000 shares, and he was supported by Sir Clarendon Hyde, who represented S. Pearson & Son, the holders of 36,000 shares; thus 120,000 to 125,000 shares, out of 180,000, were on the side of the requisitionists. Complaint was then made that (1) Mr. Bayliss had adopted an attitude "prejudicial to their interests," (2) he had originally opposed the application for a quotation of the company's shares on the Bourse, (3) he had yielded ungraciously in March and the quotation had been obtained in May by Mr. Higgins, (4) the speech of Mr. Bayliss at the annual meeting had not been outlined to Mr. Higgins, who had become a director, and the French shareholders were astonished at the tone of it, because "it gave little hope for the future and was regarded by the public as of a pessimistic character," (5) nevertheless, the profit for November was the highest ever reached, (6) and an important cablegram from the manager was not sent to Mr. Higgins, so that the French shareholders believed that they were not being treated with the consideration to which they were entitled, (7) they resented the announcement of the sale of Mexico shares by the El Oro company and (8) finally took steps to assert their rights. This was the case presented by Mr. Stewart Smith, and endorsed by Mr. Higgins, who, however, offered no personal explanation. Mr. Bayliss then replied in a long speech, in the course of which he traversed the various objections raised by his opponents and incidentally attacked Lord Cowdray, Sir Clarendon Hyde, and Messrs. Higgins and Bird. It was obvious that much bitterness had been engendered, for when Sir Clarendon disclaimed any imputation upon Mr. Bayliss's good faith, he retorted by reading correspondence with S. Pearson & Son. A dramatic touch was then given to the proceedings by the announcement made by Mr. Bayliss, that he had brought suit for slander against S. Pearson & Son. It was made evident that Mr. Bayliss had thwarted the Pearson interest (1) by refusing to authorize

the expense incidental to the obtaining of a quotation on the Bourse, (2) by deprecating the optimistic estimates of the Pearson group and their French friends, and (3) by showing scant regard for Mr. Higgins' discretion or Mr. Bird's opinion. All the other points raised by Mr. Stewart Smith were fully answered and were caused by misunderstanding between conflicting interests, so that we deem it unnecessary to refer to them. As to the first of the major points, it appears clear that the solicitor of the company advised Mr. Bayliss that he was not authorized to incur the expense of obtaining a quotation in Paris and that he did right in compelling the Pearson group to meet the cost, as it was being incurred with a view to improving the share quotations. That brings us to the chief count of the indictment, and as to this we deem Mr. Bayliss right beyond peradventure. He acted honestly and honourably to the shareholders. We commend his courage and applaud his integrity. No more need be said here, but we discuss the point separately elsewhere. But while endorsing his general attitude we recognize that he showed scant diplomacy. It is a fault of his virtues that he is inclined to be autocratic and by his disregard of the feelings of the gentlemen who are his enemies he rendered inevitable the recent eviction. In business the majority usually expect, and ordinarily get, respectful consideration. It may have been unfortunate for all concerned that the majority was represented on the board by Messrs. Higgins and Bird, against whom the late Chairman was evidently bitter, if not vindictive, but in any case it is clear that as the representatives of such a majority they were in a position, sooner or later, to assert their power. They did. But the manner in which they did it was so maladroit as to evoke much ill feeling. The final result is that the company has lost a most able Chairman, a thoroughly efficient management, and the advice of engineers of the highest character. It is a regrettable conclusion.

The Far East.

The relation of mining to politics is not often apparent, especially in the eastern regions of Asia, but careful enquiry indicates that a close relation does exist between these two diverse manifestations of human activity. As our readers are aware the operations of foreign companies in China until recently were conducted by means of concessions that were obtained, sustained, and terminated by the exercise of diplomacy. This diplomacy was frequently far from admirable, but it was the keynote to the conditions that created the opportunity for a mining industry. No better example need be quoted than the relation of coal mining in Manchuria to the political developments in the territory between the Amur and the Yellow Sea. It will be remembered that Russia had constructed the Chinese Eastern Railway and had improved the harbour of Dalny under a lease, one of the conditions of which provided that China might purchase both the railway and the harbour at cost price in 1934, or by waiting until 1976 might obtain them for nothing. Meanwhile China was to have complete sovereignty over Manchuria. But events did not take the expected course. Friction developed between Russia and Japan so that finally, in 1902, war was declared. Having foreseen that such a war was unavoidable, the Japanese had made early and complete preparations; at the first outbreak of hostilities they were able to strike hard, and in a short time the Russian armies were in retreat, the Russian fleet was destroyed, Port Arthur and Dalny were captured, and the southern half of the Chinese Eastern railway passed into Japanese possession. Then came the treaty of Portsmouth, by which Japan acquired all the Russian rights in southern Manchuria, while at the same time recognizing Chinese domination throughout the whole of Manchuria and pledging herself to restore that domination as early as possible. This pledge was repeated in a joint Russo-Japanese note

signed last summer. Japan then proceeded to rebuild her half of the Chinese Eastern railway, now called the South Manchuria railway, using the most expensive American equipment for the purpose. The coal mines at Fushun, where the Russians had begun work, were also opened on a scale sufficient to produce more than a million tons of coal annually, a production which now has been nearly attained. In August last Korea was formally annexed to the Japanese empire, railroads having previously been extended diagonally across the peninsula from the coast nearest Japan to the Yalu river, on the frontier of Manchuria. After a little pretence of trying to obtain the consent of China, another railway was constructed from the Yalu to Mukden, this road being entirely within Chinese territory and built without the permission of China. Within the last two months another coal mine has been opened at Pen-hsi-hu, to supply the needs of the new railway. Moreover, the capital so lavishly expended for this purpose was borrowed, chiefly in England. Thus we come to a natural query: Why does Japan build railways of no obvious commercial value, like that from the Yalu to Mukden; and why does she open mines that will produce more coal than can be marketed? The answer may be obvious to some of our readers: On a resumption of the contest with Russia, Japan can resume the war where it stopped and with greatly increased facilities for a successful campaign. Undoubtedly, should another war ensue Japan could, within two years, take possession of Siberia as far west as Lake Baikal. But where is the advantage of expending huge sums of borrowed money in industrial enterprises in Manchuria if Japan is to control them at the start when profits are lacking or negligible, and then hand them to China when they become really productive? The answer is simple: Japan has no intention of giving them to China. If the persistent irritation caused by Japanese aggression does not provoke China

to war, so that Manchuria may be snatched with a show of legality, perhaps China may find herself unable to command the capital required to purchase these improvements. Meanwhile many things may happen. Japan is ready to seize every advantage and will certainly let nothing escape. On the other hand, this railway-building is not a mere outlay with a view only to the future, for the unexpected development of the bean trade, to which Mr. C. W. Purington refers at length on another page, has enabled the South Manchuria railway to pay handsome dividends, while the Fushun colliery is not only a large source of immediate profit, but also a great economic asset, for the supply of coal therefrom to the shipping and export trade helps to delay the exhaustion of the Japanese resources in coal, which are limited. Nor does the matter stop here. Japanese aggression in Manchuria is a menace to foreign, especially British and American, interests in the Far East; it has already crushed American trade in Manchuria, a region rich in minerals and likely to attract the enterprising mine operator, as is explained by Mr. Purington in the interesting article to which we have already referred. American diplomacy has striven to checkmate Japanese encroachment on Chinese territory, but vainly, because Japan counts upon British support and is likely to receive Russian help, for what Japan is doing in the south Russia hopes to do in the north of Manchuria. Our American friends are naturally annoyed at the turn of events and resent the tacit support given to Japan by another English-speaking nation, it seems abnormal.

So much for details. Looking at the subject in a broad way we regard it as a conflict between the interests of two peoples whose expanding energies are brought into opposition. Japan is a comparatively sterile country with a rapidly increasing population, which is being driven by natural causes toward the Asiatic mainland, where are more fertile and less popu-

lated regions. The Russian people spread eastward from Europe, but the Russian government extended its grasp faster than the natural expansion of the people; in other words, Russia has taken possession of more land surface than she is able to exploit productively. She has failed egregiously to develop Eastern Siberia. The Russian people have more room than enough and are spread over more territory than they can develop. The conflicts of governments are nothing, it is the natural conflicts of races and peoples that must in the end determine the march of events.

Responsibilities of Directors.

The compulsory resignation of Messrs. Bayliss and Shaw from the board of the Mexico Mines of El Oro raises a point of the greatest importance to legitimate mining, for it would appear that as managers they were sacrificed to the share market. That is the blunt truth. During 1910 a campaign was waged on the Bourse, the result—and presumably the object—of which was to inflate the quotations of a group of mines in Mexico. Undoubtedly the Carmen, Nolan, and Dos Estrellas shares were 'boosted' out of all reason. Mr. Bayliss knew this, as every well informed person knew it, and when he demurred to the obtaining of a quotation for the Mexico Mines he anticipated rightly that a similar inflation would ensue. We have again read his speech at the annual meeting and say unhesitatingly that it was a moderate and conservative statement, well within the facts. As to the sale of the El Oro company's holding in Mexico Mines, it is obvious that he did right in selling at a time when it was to the interest of the El Oro company to do so; and it was also to the interest of the Mexico Mines shareholders that they should be informed that this had been done. Undoubtedly his position was difficult, but not too difficult for an honourable and clear-headed man, but it would have been per-

plexing indeed if he himself had been a speculator in these shares. He was not. At the recent meeting he was able to say, with justifiable pride, that he had never trafficked in the shares of this or any other company with which he had been connected, and by his avowal he has set a standard that we commend to every director in London. For directors are not privileged speculators, that is, speculators having first access to momentous information; they are trustees for the shareholders. As such it is better that they should be only small holders of shares, so that their interest does not run counter to that of the proprietors for whom they manage the mine. Mr. Bayliss was not chairman and director because he was a big shareholder, but because he had the ability and the experience, as well as the reputation, fitting him for such responsible duties. It is true he was evicted when his friends became a minority, but this, in our opinion, is a result detrimental to the management and injurious to the investor, that is, the man who holds his shares for their income-bearing capacity and not as counters in a mere gamble. For the gambler the tactics of the French clique will be vastly more agreeable, provided he gets off at the top, and not at the bottom, of the financial see-saw.

One point more calls for comment. At the basis of all this discussion lies the query: What are Mexico shares worth? Was Mr. Bayliss "pessimistic," as his enemies claim, or was he only truthful, and truthful to useful purpose. Obviously, if as chairman he needlessly or wantonly depreciated the property of his shareholders he was disloyal to his trusteeship and we would look for a sinister motive. On the contrary, our own information goes to show that not only was he reasonable in his judgment and properly frank in his statements, but we find cause to commend his reticence at the recent meeting when he was being hounded from office. We appreciate that if he had cared to substantiate the accuracy of

his estimate and justify the moderateness of his predictions, he could have done so readily, to his personal gratification, but to the injury of the shareholders and the mortification of the boosters on the other side of the Channel. He owed a duty to the shareholders; we owe one to the public. On the basis of the ore reserve, together with the probabilities of further development as known six months ago, the shares were considered to be worth £5, or about one-half the highest price at which they have been quoted. Since then the disappointing results on the lower levels have gained in significance, for the top of the zone of impoverishment that passes through the El Oro mine at the fifth level, and the Esperanza at the sixth level, cuts through the Mexico ground at the eighth level, as it extends northward through faulted ground, so that the poor results in the bottom of the Mexico mine presage, we believe, something more than a temporary decrease of productiveness. After all the Mexico is a "little" mine, for the ore-bearing ground is only about 800 ft. square; on the third level the main lode was profitable for 1200 ft., on the fifth for 950 ft., on the sixth for 500 ft. The west or sulphide vein proved a valuable asset, but the tonnage extracted has been relatively small, and at the eighth level this vein also is showing impoverishment, as it does in the Esperanza, where it was wonderfully productive. According to the published figures the Mexico has ore in reserve that will yield £2 per share in profit, and to this another £1 can be added for ore reasonably certain and for cash in London. Thus £3 is fairly assured, but £4 is more than appears probable. On the whole the evidence available indicates that the Mexico shares are hardly worth—as an *investment*—one half the present price. In other words, we are much mistaken if, in the years to come, Mr. Bayliss's speech of September 20, 1910, is not regarded as a temperate and justifiable understatement of disagreeable facts, the meaning

of which it was incumbent upon him to convey to the shareholders. Thus we conclude that he did his duty as a chairman and as a director at a time of crisis, and, whatever his shortcomings as a diplomat, he discharged honourably the obligation owed by a trustee to those who trust him.

Control and Management.

At the annual meeting of the Giant Mines of Rhodesia Ltd. it was stated that the board of that company occupied an "anomalous position. They managed the company, but one of the shareholders—the Consolidated Gold Fields of South Africa—managed the mine." This referred to the fact that the Gold Fields group, which formerly had a big holding, has sold most of its shares, as indicated in the last annual report. It was stated that the persistent drop in the quotation between March and July last year was due to the liquidation of the Gold Fields' interest, whereupon the shareholders in Giant Mines were invited to criticize the Gold Fields for retaining control after the latter had ceased to be a predominant partner. To this Messrs. E. S. Birkenruth and H. T. Knatchbull-Hugessen replied by denying that the Gold Fields had sold the shares on any information not available to Giant shareholders; they said that the Consolidated company was quite willing to retire from the engineering management of the Giant, and that if it were the desire of the majority of the shareholders the two Gold Fields directors would retire from the directorate of the Giant Mines. To this Mr. Birkenruth added that the Gold Fields company derived its income from speculative holdings, which, from time to time, it had to sell, in the interest of its own shareholders, to whom, and not to any subsidiary company, it reserved the right to make explanations when demanded. This episode bears a likeness to the Mexico Mines affair and to the Luipaard's Vlei, which is managed by the

Gold Fields, although in that case also the Consolidated company has parted with most of its shares. Thus the question arises whether directors individually or collectively should remain members of the administration after they cease to represent a majority of the company's shares. Mr. Bayliss has been blamed by his French critics for selling the El Oro company's block of Mexico Mines shares and for stating the fact frankly in the annual report of the El Oro Mining and Railway Co. He ceased to represent a majority, and, having offended them, they turned him out incontinently. Apparently the Giant Mines and the Luipaard's Vlei shareholders are not in a hurry to eject the nominees of the Gold Fields. They do well. At least, they ought to have a better reason than the one stated. Adequate reasons would be mismanagement or misuse of information for speculative purposes. The first is not asserted and the second is not substantiated. On the other hand we are aware that those representing the majority of shares in the Luipaard's Vlei are inclined to regard the Gold Fields' management as an asset with which they are loth to part. Whether the Giant Mine has been as well managed, we do not know; we have criticized the cryptic nature of some of the reports, but we have no reason to suppose that the untechnical terminology and obfuscated information is evidence of sinister purpose; on the contrary, we have animadverted upon these features on the assumption that we were addressing honourable men who were desirous of doing the right thing, but erred through a carelessness only too common in matters of this kind. Thus we regard the management of mines by the Gold Fields, as by the Exploration Company, to be efficient and effective. That being so, should they be relieved of the responsibility as soon as they represent a minority? We think not. Good management is not so common as to be disregarded, and shareholders

will do well to pause before losing the benefit of such an aid to successful exploitation. In deed, we hold that if it were possible to secure good management at the hands of experienced men, not themselves large shareholders, nor representing large shareholders, nor agents for in-and-out speculators, then it might be possible to get mines directed, not with one eye on the Stock Exchange, but in the sole interest of the investor, namely, the man who holds mining shares for the income derived therefrom. This ideal condition is not likely to be created often, but when it does exist it is well to preserve it. Obviously the question presents many aspects, of which one more may be mentioned. It is this: If the Exploration or the Gold Fields companies obtained control on the basis of their representing the majority of shares, then when that majority dwindles to a minority, they ought to tender the resignation of their directors, and the shareholders of the subsidiary company could accept or refuse to accept the resignations as they saw fit in their own interest. If, on the other hand, the 'big house' was given the management, not on account of its shareholding, but because it could supply a peculiarly skilful corps of engineers and administrators, then, of course, the size of the shareholding would not be a factor. We believe that this latter arrangement is rare and that as authority goes with power, so management usually goes with control; but not always; we could mention the names of firms of engineers to whom the engineering work of mines is given not on account of the ownership of a big block of shares but because it brings to bear a special experience or an unusual skill. Such firms are supposed to hold themselves aloof from share dealings on a big scale, but some of them do not, and in so far as they do not, they are in the same position as the financial houses, to whom engineering is a subordinate, although essential, accomplishment.

SPECIAL CORRESPONDENCE

News from our own Correspondents at the principal mining centres

JOHANNESBURG.

Sand-filling.—Of the many mines of the Eckstein and Gold Fields groups that are now filling old stopes with tailing, the Village Deep is apparently working the scheme on the biggest scale. One to two thousand tons of sand are handled per day. The sand, drawn from the dump and not from current sources, as on the Simmer & Jack, is tipped into a brick-lined pit or bin, from which it is sluiced into a pipe-line passing down the old vertical shaft of the Village Main Reef shown in the accompanying photograph.

Randfontein Central.—Whatever criticisms may be hurled at the control of the Randfontein mines, and whatever calm doubts may be expressed as to their ability to fulfil the requirements of the published agenda list, the efficiency of the colossal new reduction plant and electric-power station cannot be questioned. The engineers responsible, D. Gilmour, T. P. Butt, and C. W. Hutt, are to be congratulated upon the completion of their magnificent work, which is marked by vast capacity and the highest efficiency. The unexampled opportunities offered to the engineers in the erection of a new plant of 2,000,000 tons annual capacity, out on the open veldt, where appeared none of the disadvantages of existing units calling for alteration or extension, and at a period in Rand metallurgical history rich with the accumulated experience of 23 years of progress, have been turned admirably to account. The members of the South African Association of Engineers recently visited the plant, which comprises 600 stamps of 1650 lb. in 10-stamp units, besides 16 tube-mills. The mill-bins have storage capacity for 13,000 tons. The concrete mortar-box foundations contain a longitudinal tunnel into which all the bolts pass. There are no plates below the stamps, all the amalgamation taking place on stationary plates below the tube-mills. The sand-plant comprises 36 steel vats of 60 ft. diameter, and the slime-plant has 23 vats, 70 ft. diam., with conical bottoms 7 ft. deep. The solution-vats are 60 and 70 ft. diam. Concrete has not been used so extensively as in the City Deep mill. Ore is to be conveyed from the shafts to the mill in 40-ton hopper trucks, such as are being in-

troduced on the majority of big Rand mines today and the sand residue will be transported to the dump in 30 cu. ft. trucks. Magnitude is the keynote in groups and units. Even at this eleventh hour, when the utmost optimism prevails as to the successful operation of this huge plant at the beginning of 1911, another word of doubt must be expressed. Mechanical difficulties, there should be none; the problem will lie with the underground men who are called upon, in these new mines of narrow



Old Village Deep Shaft

stope-widths, to keep the mechanical monster amply fed.

Klerksdorp Main Reef.—The reported strike of the Main Reef series on the farm Cyferfontein, in the Klerksdorp district, 100 miles southwest of Johannesburg, calls to mind the fruitless Klerksdorp Main Reef discussion of 1903-'04. At that time, there was a positively unseemly scramble among the "colour geologists" as G. A. Denny dubbed them, for the genuine extension of the Main Reef in this 'far western' area, where "green quartzites" and "red bars" provided the stratigraphical markers. Klerksdorp is situated near the western end of the Witwatersrand basin, but the various sub-divisions of the formation change

secretly that the utmost difficulty prevails in defining correlations. Still more difficult is it to identify individual beds of banket, of which so many occur between the Government and Elsburg series. However, a diamond-drill is reported to have struck the Main Reef series on Cyferfontein No. 390, to the north of the old Buffelsdoorn, giving an assay of 39 dwt. over 12 in. The danger of expressing enthusiasm over any early report from the Klerksdorp district has been so often exemplified that it will call for further evidence before we can hope that a valuable 'reef' has been cut or that we are any nearer tracing the Main Reef (with its uniform grade) into this long prospected area.

Dust and Phthisis.—When Dr. Aymard first outlined his scheme for catching the dust at the drill-hole, by means of a sack held in position by a light iron support, he received little encouragement from mining men. It was urged that the dust created by detonation and 'shovelling' was far more serious than that formed in actual drilling. Having seen the device at work under normal conditions when there was no official 'demonstration' in progress, I feel satisfied that its success is assured in certain classes of work, until something better is invented. A great footage of vertical mining is done on the Rand with small machines, notably rises, ore-chutes, and box-holes, and in back-stopes. The necessary dry holes result in the creation of dust in deadly quantity, and although "only natives" are, as a rule, called upon to work continuously in these places, common humanity demands the application of preventive measures, if possible. No reliance can be placed on the use of water in spite of regulations. But the simple scheme of fixing a wet sack to the collar of the hole, by which the dust is caught before it can fly, promises to provide a solution of the difficulty that is moderately efficient and thoroughly workable.

Consolidated Gold Fields.—While the three wealthiest mines of this group continue steadily to maintain their profits, slightly reduced from the figures shown earlier in 1910 through labour stringency, there have been notable changes in the results of the lesser companies. The marked rise in the profits of the Simmer Deep is balanced by the fall in the Simmer East, and the lonely West Rand mine of the group, the Luipaard's Vlei, has apparently improved its position. The Simmer Deep's £8000 profit in November compares with £3000 to £5000 previously, and the Simmer East's £1500 profit in November

compares with £6000 in May. The Simmer East is disappointing, as it does not return the gold indicated by the estimate of ore reserves. In the superintending engineer's report for the Gold Fields, appears the following summary of 'milling tons' and value:

Mine	Reserve tons	Content dwt. per ton
Simmer & Jack.....	2,650,000	6'3
Robinson Deep.....	1,100,000	7'2
Knights Deep.....	1,650,000	5'5
Simmer East.....	925,750	5'4
Simmer Deep.....	1,310,000	5'0

Allowing for residue gold, the average yield indicated may be compared with the November declaration as under:

	Indicated yield	November yield
Simmer & Jack.....	25s.	26s. 6d.
Robinson Deep.....	28s. 6d.	31s. 6d.
Knights Deep.....	21s. 6d.	19s. 6d.
Simmer East.....	21s.	16s. 9d.
Simmer Deep.....	19s. 6d.	20s. 6d.

It will be seen that the estimates are fairly well maintained or exceeded, with the exception of the Simmer East, where the difference is serious, even allowing for low-grade development rock. The yield in October was 18s. per ton, still showing a considerable percentage of difference. Small variations may always be expected, due to changes in the ratio in which the blocks are worked and in the percentage of ore mined from development faces and sundry sources.

Shrinkage System.—This system of stoping, adopted widely in America and Western Australia, has been little employed on the Rand. As a safe scheme for working steep lodes—as in the East Rand and Randfontein districts—it has possibilities well worthy of discussion, although it may be understood at the outset that few mines on the Rand today are in a position economically to store the accumulations of broken ore demanded by the practice. Further, the success attending hydraulic sand-filling underground promises to point to a more advantageous method of back-stoping in steep formation. G. H. Smith has described with commendable detail the introduction of the shrinkage system in the Ferreira mine, one of the old outcrop mines of the Central Rand, whose steep stopes are unfortunately nearing exhaustion. In his paper before the Chemical, Metallurgical & Mining Society, Mr. Smith has given an account of actual experience that should prompt discussion of an instructive character. He summarizes the advantages as simplicity and safety, applicability to varying stope-width, improvement in ventilation,

economy in shovelling, and the disadvantages as the accumulation of broken ore, inconvenience due to possible withdrawal of too much ore, and reduction in stoping efficiency due to the dry holes occasionally required. It has been rightly pointed out by C. B. Saner and H. M. Coombe that the Ferreira mine cannot claim to have first introduced this system on the Rand. The practice was in vogue, in one or two mines, before the War. Mr. Smith was wrong in this historical point, but there is no less credit due to him for having presented the first scientific and comprehensive paper on the subject to a Rand society. The man who would introduce something "new" in stoping or underground conveying practice on the Rand, something that has never been tried in the tens of thousands of stopes opened up in the last twenty years, must be original

ference to a "25½ in. stoping-width" for the Main Reef, we may note that the leader gives 178 in.-dwt. or say 5 dwt. over a stoping-width. Averaging this with the original intersection, the grade indicated is 3 or 4 dwt. Of course, no reliance can be placed on two drill-cores; very little, from the valuation standpoint, could be placed on twenty of them in an East Rand property. However, Mr. Dale Lace declares to shareholders: "I am entitled to summarize what these results mean by saying that you have in Vlakkfontein a property of over 7000 acres containing Main Reef throughout, proved at a workable depth, with payable values." This is what may be emphatically termed a sanguine view.

SAN FRANCISCO.

Political changes in California seem likely

to benefit the mining industry in many ways: Better methods of taxation will equalize the burden of public expenditure and with the removal of the bars erected by 'special privilege' development is sure to follow. At present, attention is concentrated on one particular in which mining is apt to receive benefit. The Governor-elect, H. W. Johnson, is strongly pledged to the appointment of fit men to office in the public service and this makes it practically certain that a new man will be made State Mineralogist. The present incumbent



The Robinson Central Deep Mine.

indeed. It often happens, however, that valuable experiments are undertaken and the results lost to the industry, through the reticence of the operators or through their inability to realize the true significance of the knowledge gained.

Lace Proprietary.—This company is to be commended upon its enterprise in diamond-drilling on Vlakkfontein in the East Rand, and to be congratulated upon the optimism of the Chairman. The first core was hopelessly unpayable. A successful deflection was made and the second core showed "13.2 dwt. over 13½ in. for the leader," and "4.7 dwt. over a stoping-width of 25½ in." for the upper portion of the Main Reef. Ignoring the strange re-

ference to a "25½ in. stoping-width" for the Main Reef, we may note that the leader gives 178 in.-dwt. or say 5 dwt. over a stoping-width. Averaging this with the original intersection, the grade indicated is 3 or 4 dwt. Of course, no reliance can be placed on two drill-cores; very little, from the valuation standpoint, could be placed on twenty of them in an East Rand property. However, Mr. Dale Lace declares to shareholders: "I am entitled to summarize what these results mean by saying that you have in Vlakkfontein a property of over 7000 acres containing Main Reef throughout, proved at a workable depth, with payable values." This is what may be emphatically termed a sanguine view.

is but a spoils politician with a smattering of mining knowledge and a keen sense of the value of advertising as affecting his personal advancement. Some time since a number of prominent and capable engineers, finding it impossible to secure any good results, resigned as members of the Board of Trustees of the California State Mining Bureau, as the institution over which he presides is called. There have been many unavailing protests over present conditions and at last there is hope of a change. The Bureau has large possibilities of usefulness. It maintains a museum in San Francisco and publishes statistics and bulletins relating to the mining industry. In the past,

many excellent reports have been printed, and recently the dredging industry has been discussed in a report of real value, though for that the State Mineralogist deserves small credit. In general, the Bureau compiles and disseminates information regarding the mineral resources of the State. It is evident that its influence will be in direct ratio to the confidence that its reports inspire and for that reason a competent director is important. The Bureau does not carry on research and thus differs from the geological surveys maintained by most American States. California at one time began a geological survey and the work was organized according to the best standards for such work, under the direction of J. D. Whitney. The work was too scientific for the time and place and when Whitney insisted on publishing a paleontological memoir, the members of the Legislature refused to grant further funds. It is believed that a proper presentation of the case for scientific surveys would now be given better support.

Conflicting Estimates. The Utah Consolidated Mining Co., operating one of the largest copper mines at Bingham, Utah, is in trouble over ore reserves and there has been an exposure similar to those relating to Granby, Federal, and North Butte, earlier in the year. It will be recalled that the principal property of the Utah Consolidated is the Highland Boy mine which was developed with great profit by Samuel Newhouse and associates, and sold in 1903 to people connected with the Amalgamated Copper Co. The mine, while not so large as its neighbours the Boston Con. and the Utah Copper, has been very profitable because of the higher grade of the ore. In January 1907 the shares were quoted at \$79, from which they have now dropped to \$15. The profits per share in 1906 were \$9.45 and in 1909 \$0.51. Some of this decrease is properly chargeable to the lower prevailing prices of copper and silver, some to the higher charge for smelting since the company's own smelter was closed as a result of trouble with farmers over smoke damage, and some to decrease in the metal content of the ore. The 296,989 tons mined in 1906 yielded at the rate of 62.4 lb. copper per ton with 1.6 oz. silver and \$2.87 gold. In 1909 the ore averaged 35.8 lb. copper, 1.07 oz. silver, \$1.54 gold. The mine was managed for some years by R. H. Channing who recently returned to it from Cerro de Pasco. While he was in South America J. B. Risque was in charge of the property. At the beginning of last year Mr. Risque placed the ore reserves at 1,237,470 tons. This estimate was

checked in February by J. W. Finch, an independent engineer, who credited the mine with 1,121,360 tons. Since then 130,000 tons has been mined and a further drop in the price of copper has rendered unprofitable a portion of the material counted as ore in February. Mr. Channing on his return to the mine this fall made a hurried inspection and decided that the reserve was not as large as had been estimated by Mr. Risque and Mr. Finch. U. H. Broughton, president of the company, promptly arranged for a conference at Salt Lake at which Mr. Risque, Mr. Finch, Mr. Channing, and C. C. Berger, the latter an engineer recently associated with J. H. Hammond, were present. It promptly became apparent that the essential difference of opinion was as to what should be considered as 'in reserve' where it was impossible to examine ore on four sides. Subsequently Mr. Berger made an examination and sided with Mr. Channing, placing the ore 'in reserve' at 300,000 tons, averaging 2.32% copper, \$0.50 gold, 0.85 oz. silver. So far there would be no great disagreement among the engineers, though Mr. Finch and Mr. Risque would contend for a somewhat larger amount of reserve even under this narrow definition. Mr. Channing and Mr. Berger, however, only consider 100,000 to 250,000 additional tons to be recoverable from old stopes and pillars. Mr. Risque and Mr. Finch place the amount much higher. To reconcile this difference in estimates it is necessary to understand that the orebody is a great mass of pyrite replacing limestone. From the time the mine began to be worked a series of maps has been kept showing the floors in each stope as it developed and assay of the ore in each set. These maps have been used as a guide in mining and found accurate enough not only to estimate tonnage but to determine in advance the grade of the ore that could be mined. As the mine is worked by top-slicing there are always numerous pillars surrounded by waste and the difference in estimates really resolves itself into a question of how these pillars shall be regarded. The ore is not 'in reserve' in that the engineer cannot go underground and lay his hands on it, nor can he see it on four sides. At the same time the method used by Mr. Finch and Mr. Risque in estimating it is that used regularly at Butte and found satisfactory. In the original reports the tonnage estimated was classified, discriminating between "positive developed" ore, and that estimated upon the basis of records and assay maps. Making due allowance for the lower price of metals and possible changes in mining conditions, it should

be possible to revise the early estimates without any such discrepancies as appear in the statement just published. Mr. Channing made an excellent record for cost when first at the mine and Mr. Risque handled a difficult situation as regards caving ground, by skilful use of filling. This year, apparently, the directors have not allowed enough to be spent for development and Mr. Risque would possibly have better protected his reputation by resigning earlier, since under those conditions it was impossible to turn the mine over to a successor in good shape. Apparently the lack of unanimity among the directors has complicated matters. On the whole, affairs for the stock-holders seem likely to improve rather than the reverse. As to the engineers, it is evident that they need

sumably from the earnings of the refinery operated in New Jersey, and there are rumours that the rate is to be raised to 10%. It is also said in New York that the second of the plants contemplated in the West is to be built shortly. Stock in the I. S. & R. Co. is closely held by the Cole-Ryan group of financiers. There has at times been a disposition to comment severely on the fact that it has paid excellent dividends while the Cole-Ryan mines, in which the public holds a much larger interest, have not generally done well. The close association of T. F. Cole with the U.S. Steel Corporation and of J. D. Ryan with Standard Oil men has pointed to them as probable leaders whenever the much expected copper merger comes to be formed. Popular indifference to mining stock



THE BOSTON CONSOLIDATED MILL, UTAH.

to instruct the public as to proper differences of opinion in estimating 'ore reserves.'

The International Smelting & Refining Co. is popularly supposed to have been hit hard by the collapse of the Utah Consolidated. The new smelter built in Pine canyon, Utah, was erected especially to handle the ore from this mine and an expensive aerial tram had been built across the mountains to connect mine and mill. This tram had not been accepted by the company when Mr. Broughton published his statement as to ore reserves. The officers of the smelting company state that contracts have been made with other mines and that the new smelting-plant will have an abundant supply of ore. In the meantime the I. S. & R. has been paying 8% dividends, pre-

of any kind, however, still serves to postpone that flotation. It is more than suspected that its projectors have an eye rather to the millions of securities to be sold than to economies in operation.

Alaska copper mines have been much in the public mind of recent years, but the actual output of copper has been small. It is cheering to know that the Beatson mine on Latouche island, in Prince William Sound, is likely to increase shipments. This mine, which attracted the attention of A. K. Beatson in 1897, has recently passed into the hands of the Guggenheim-Morgan interests. It cost the original owners approximately \$100,000 in purchase price and development, beyond which it has paid its own way. Owing to the death

of one of Mr. Beatson's partners, the enterprise has been in the hands of a receiver for a year, but has now been transferred to the Beatson Copper Co., capitalized for \$3,000,000. Of this, one third goes to the old owners and two thirds to the new. In addition, there is a bond issue of \$700,000, bearing 6% interest rate. Bonds to the amount of \$550,000 go to the old owners and the remainder to the new in return for cash to be expended in additional development and erection of a concentrating mill and other plant. The ore-shoot lies in greenstone and is large. The examining engineers figure a profit of \$1,250,000 on the ore in reserve with copper at 13c. The profit from exploitation is to be used first to retire the bonds. The ore so far shipped has run 10 to 11% in copper after some hand-sorting, and is sent to Tacoma, in Washington, for smelting. The profit last year was over \$50,000. There is a deep-water harbour on the property and excellent opportunity for cheap production.

At Nome the dredges did well in 1910, having enjoyed a longer season than was expected when the last boats came down. Recent advices state that the Nome-Montana-New Mexico dredge on Solomon river did not stop work till November 13 and took out \$15,000 after most of the other dredges had closed down. In 1909 the season at this dredge closed October 27. The 1910 season was the longest since dredging began on Seward Peninsula. A number of new boats were launched and the old ones made good runs. Among the dredges constructed in 1910 were those of the Sioux-Alaska Mining Co., on Moss Gulch; the Plein Mining & Dredging Co., on Otter creek; the Arctic Gold Dredging Co., on Saunders creek; Sievertsen & Johnson, on Solomon river (their second dredge); the Flodin Mining & Dredging Co., also on Solomon river; the Solomon Dredging Co., near the confluence of East Fork and Solomon; the Alaska Gold Dredging Co., on Willow creek; the Wild Goose M. & T. Co., on upper Ophir creek. An interesting feature of the new dredges is the employment of gasoline engines. The Wild Goose dredge, for example, is driven by a 100 hp., 6-cylinder, marine-type of engine made in San Francisco. As coal is very expensive at Nome gasoline is coming into more general use. At the same time the Associated Oil Co. has erected a storage-tank and furnishes crude oil at \$2 per bbl. so that steam continues to be used. Eventually, central power-stations and electric transmission will doubtless be adopted in some parts of the district. Plans for such a station on Solo-

mon river are now being considered by A. J. Condee, manager for the Three Friends dredge. Mr. Condee estimates that power can be supplied at a cost of \$7.50 per hp month; a price that compares favourably with that at some of the mines in Nevada.

SALT LAKE CITY.

Copper.—The most important event of the year was the merging of the Utah Copper and the Boston Consolidated, which was effected by the exchange of one share of Utah for $2\frac{1}{2}$ shares of Boston. This plan was subjected to criticism as it claimed the Boston was selling for \$22,000,000 less than the value placed on Utah, and many persons held that development would prove that it was the equal of Utah. The merger was temporarily restrained by an injunction secured by Col. E. A. Wall, but was completed on February 1. Immediately after, Utah offered to exchange one share for $2\frac{1}{4}$ of Nevada Consolidated and in this manner control of the Nevada company went to Utah. The Utah Copper put steam-shovels at work to strip the ground acquired from the Boston Con. with the intention of abandoning the underground methods previously in use. Three new shovels were bought during the year so that 20 can be kept at work continuously. Plans were made to increase the capacity of the Utah mill from 6000 to 10,000 tons per day and the Boston from 3000 to 6000. The method of crushing by gravity stamps in use at the latter will be superseded by rolls and Chilean mills, thus following the system of the Utah Copper mill.

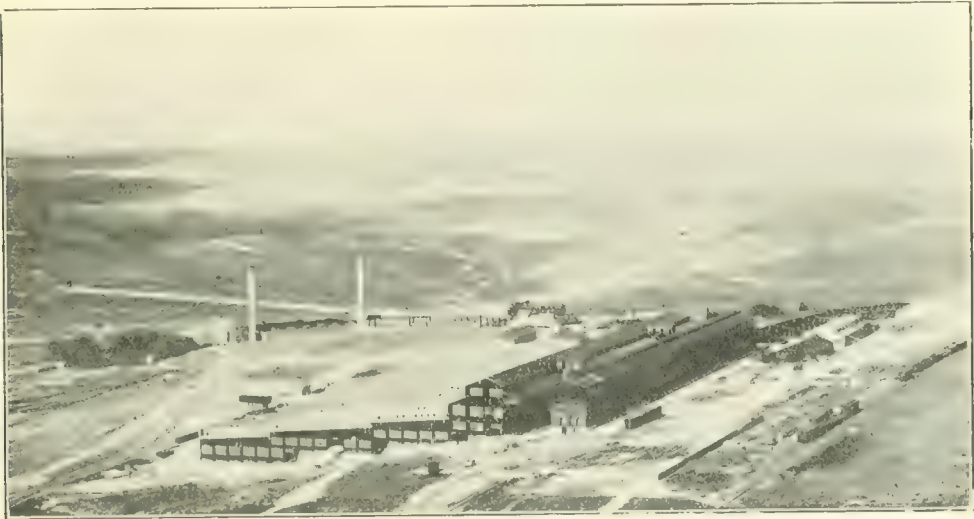
During the year prospecting was continued by means of churn-drills, and the management announces that there are now developed on the combined property 170,000,000 tons of ore. The average grade is decreasing, which seems to be the case as depth is gained on the porphyry deposits, and the average for September, the last month for which a report has been made public, was only 1.4% copper. In August the Utah production was cut down about 8%. That this decrease is to be only temporary is evinced by the preparations that are being made for shipping and treating a larger tonnage than ever. Assuming that production and costs will be the same for the fourth quarter as for the third, the total output of this company for the year will total 90,025,713 lb. at an average cost of 8.086 cents per pound. Net earnings, on this same basis, are \$3,948,207.77 and dividends \$4,645,608.50.

The Yampa found that when it mined a

sufficient tonnage to permit economical operation of the smelter the average grade was so low that there was no profit at prevailing prices of copper so the smelter was closed in August and shipments of a small tonnage of selected ore were made to the Garfield smelter. Production for the year is about 6,000,000 lb. The South Utah, better known as the Newhouse, started its mill in September after being shut down since April 1909. The mill was remodelled to provide for a production of 10,000,000 lb. per annum. About 1,000,000 lb. was produced this year. The Utah Consolidated closed its contract with the Garfield smelter and commenced shipping

120,000,000 to 125,000,000 lb. copper for the State of Utah is estimated.

Smelting.—The first of the year found two lead and two copper smelters operating. During the year one copper smelter was closed down and one was started. Construction of the Tooele plant was completed during the year and calcine was charged in August. The plant has worked well but has been hampered by lack of ore. The contemplated expansion of the Utah Copper caused the Garfield smelter to commence enlarging its capacity to meet the new requirements. When these plans are carried out this will be one of the largest copper plants in the world.



THE UTAH COPPER CO. PLANT AT GARFIELD

to the new plant at Tooele. Toward the close of the year startling disclosures in the matter of ore reserves sent this stock down to \$12'50. The previous engineer's report gave a reserve of 1,200,000 tons, which it was found dwindled in less than a year to 300,000 tons, only 130,000 tons being shipped in the meantime. Utah Con. production will approximate 5,500,000 lb. copper. The Ohio mill has been operating one unit. Several attempts to finance the company so as to equip the other unit have failed. Production for the year was about 9,000,000 lb. These mines are the largest, but there are many others producing copper on a smaller scale. The Tintic district produces considerable copper but Tintic companies are adverse to giving out any statements and the production of this district can only be guessed. A total production of

The United States Smelting Co. secured a modification of the Court decree that has caused it to close its copper plant, so that it can treat copper ores by making certain changes. No date has been set for the resumption of copper smelting. The closing of the Yampa smelter has been mentioned.

Nevada.—The Ely district was the only one that produced any considerable amount of copper. Mason Valley and Yerington did active development and will be productive this year, when there should be a smelter in operation in each district and a new railroad into Mason valley. The Nevada Con. acquired control of the Cumberland Ely by exchange of shares and later bought the property of the company. Despite vigorous contest control of the Nevada Con. went to the Utah Copper, and the President, Hamer Phillips, re-

signed at the annual meeting. Nevada Con. began stripping on the Liberty pit and put the Star Pointer shaft in shape for production. By prospecting the ore reserve was increased to 40,360,823 tons at the close of the fiscal year, September 30. During that period 1,136,431 tons of ore averaging 2.06% were mined at a cost of 15.4 c., or with pre-paid stripping charges added, 30.4 c. per ton. The concentrator capacity was increased from 6000 to 8000 tons, but production was decreased 15% in August. Production was 62,772,342 lb. at a cost of 7.37 c., deducting miscellaneous earnings 6.42 c., allowing for depreciation and improvements, 7.05 c. per pound. Net earnings were \$3,580,786 and dividends \$2,982,644. The Giroux confined its efforts to development work, completing the new 5-compartment shaft, installing pumps, and erecting a steel head-frame. Ely Central suffered seriously when its financial agents, B. F. Scheffels & Co., were arrested by the postal authorities and the property was closed down. It is heavily in debt, the labour being unpaid, and various proposed re-organization plans have been rejected. Ely Consolidated went into the hands of a receiver and was sold to the largest creditor.

Pioche was put out of commission by serious wash-outs, which deprived it of railway transportation for the first seven months of the year. With the railroad re-established most of the mines resumed. A syndicate with strong financial backing took over the Nevada-Utah with the intention of merging it with the Ohio-Kentucky and the Pioche Con., thus reconciling properties that have been at war for years. A merger of five of the smaller properties was effected and an option for the sale of the Pioche Demijohn given. It is believed in Pioche and among the mining men of Salt Lake that the dominating influence of the new management is the same as that of the Amalgamated Copper Co., usually designated as 'Standard Oil.'

Gold.—The Goldfield Consolidated eclipsed all other mines in America in the matter of profits, paying \$8,917,670. This was done notwithstanding the fact that the greater part of the mill was out of commission for about three months on account of fire. Production was kept up during this period by the shipment of high-grade ore to the smelters. Two new camps, Jarbidge and National, attracted considerable attention during the year. National is a high-grade camp, but Jarbidge has proved under development to carry mostly low-grade ore, although in good quantities.

TORONTO.

Porcupine.—The Ontario Government has undertaken the construction of a branch line of the Temiskaming & Northern Ontario Railway to Porcupine, from a point on the main line about two miles north of Kelso. The distance will be about 32 miles, and the cost is estimated at \$450,000. No serious engineering difficulties exist and the line is expected to be ready for operation by July next. Work is now being pushed, Joseph M. Bourke having been placed in charge. The Government had previously granted a charter to local people for the construction of an electric railway to connect Porcupine with the Temiskaming & Northern Ontario Railway at Matheson, but considerable delay in starting the work ensued and it was finally turned over to A. E. Wallberg. He began operations only a few days before the concession was cancelled, owing to the non-fulfilment of its conditions. The Government has taken over the equipment and supplies purchased by Mr. Wallberg.

With a solution of the transport difficulty in sight and the winter roads in good condition to permit the forwarding of machinery and supplies, a great stimulus has been given both to active development and speculation in mining properties. A boom is anticipated, many sales at high prices are reported, and a large number of mining companies have been incorporated. It is doubtful, however, whether the market is likely to be in a receptive condition for new stock issues for some time to come. The public has been so badly victimized by a series of mining enterprises in connection with Cobalt, Larder Lake, Elk Lake, and Gowganda, which offered shares at heavy discount, but when active development was pushed soon found themselves without funds. No repetition of the boom of the earlier Cobalt days is likely. Moreover, all investors with a grain of common sense understand the wide differences between the possibilities of Porcupine and those of the silver districts, and that while the latter, under favourable conditions, may prove productive from the outset, the Porcupine mines require ample capital from which no return can be expected for years. It is altogether probable, therefore, that some of the promoters who are paying big money for unproved claims in the hope of unloading shares on the public at bargain-counter prices, will be badly disappointed. The Government, moreover, is closely watching the results of its policy with a view to enacting more drastic legislation against fraudulent

mining schemes. A few days ago the Minister of Mines left on a visit of inspection to Porcupine so as to familiarize himself with conditions on the spot, and it is announced that on his return the course of the Department will be definitely determined. In the meantime the provisions of the Mining Companies Act as regards prospectuses and advertisements are to be strictly enforced. The aid of the Canadian Mining Institute in suggesting legislation for the amendment of the law has been invited.

Sales of Property.—Among the more important transactions in Porcupine claims recently reported are the sale of the Maiden Macdonald group, about a mile south of Tisdale township, at a price stated at \$250,000, the Josey group in Deloro for \$150,000; the Gode-Burns group in Shaw township to Toronto buyers for about \$100,000; and the three Walsh claims in Eldorado township to Montreal and New Brunswick capitalists under option for \$50,000. The Timmins-McMartin-Dunlop syndicate have bought and hold under option in all some 50 claims having a total area of 2000 acres. The majority of these are in the neighbourhood of the Hollinger and the McMahon. The small plant now operating has crushed about 300 tons since it started. The syndicate has applied for a charter for a milling, concentrating, and refining company, under the style of the Porcupine Gold Milling Co., capitalized at \$500,000, and will install a 30-stamp mill immediately, with provision for increasing the number of stamps as required.

The Cobalt market of late has been decidedly quiet and shows strong evidences of the decline of the purely speculative spirit, transactions being regulated almost altogether by the dividends. While stocks of the dividend-paying companies remain firm, there has been a steady decline in the lower-priced issues, even of actively producing mines that have not yet yielded returns. Shipments, though showing no noteworthy increase, have been well maintained, and some particularly good dividends have recently been declared. The Buffalo, in addition to its regular quarterly dividend of 5%, has declared 'special' and 'extra' dividends, bringing the total to 13%. The Crown Reserve has declared its quarterly 6% dividend and a 9% bonus. The McKinley-Darragh supplemented its regular quarterly 3% dividend with a 12% bonus. The Nipissing declared its quarterly 5% dividend and an extra dividend of 2½%. The Right of Way paid its regular 2% dividend, as did La Rose. The expectation that the last-mentioned would re-

store the former rate was not fulfilled, the directorate adhering firmly to the policy of accumulating a large cash reserve before increasing the dividend. The Trethewey makes a distribution of profits amounting to 10% on the share capital. The shareholders are asked to consent to an increase of the capitalization to \$2,000,000 by an issue of treasury stock to be used for the acquisition of new properties. The Peterson Lake and Nova Scotia companies, between which a lawsuit is in progress over a disputed area, have agreed that all ore taken from this strip shall be milled by the



The end of the Road, Porcupine

Nova Scotia and shipped, the proceeds being retained by Peterson Lake until the case is decided by the courts. November was a good month for the Nipissing, which mined ore of the net value of \$200,851, of which \$84,000 came from the Fourth of July shaft. At the La Rose the development of the new vein paralleling the main vein has been pushed with highly satisfactory results. On the Lawson property between 40 and 50 ft. of high-grade ore has been developed at the 188 ft. level. An average of 11 assays of the ore in the centre of the drift gives 4618 oz. The Hargrave has cut a vein of high-grade ore 700 ft. north of its No. 3 shaft, close to the Kerr Lake line but curving back into Hargrave territory.

Silver production.—According to returns issued by the Bureau of Mines the shipments of the silver mines of Ontario for the first nine months of 1910 aggregated 23,924 tons,

of which 10,191 tons were ore and 1633 concentrate. The former averaged 268 oz. silver per ton, and the latter, 990 oz. Nearly all the output was from Cobalt, the conspicuous failure of the other silver areas being shown by the very limited production; Gowganda only contributing 402 tons of ore; Elk Lake 17 tons, and South Lorrain 9 tons. In addition to ore and concentrate Cobalt shipped 468,887 oz. of silver bullion. The total production of silver was 19,791,033 oz. valued at \$9,792,669, as against 18,751,549 oz. of the value of \$9,385,600 for the corresponding period of 1909. Considering that during the present year the camp has had the advantage of cheap electric power and many additional plants these figures are somewhat disappointing and coupled with the fact that the new shippers are few and far between, hardly making up for those disappearing from the list, they seem to indicate that the limit of production has about been reached. The Sudbury mines yielded 13,905 tons of nickel and 7168 tons of copper, as compared with 8912 tons nickel and 5587 tons copper in the corresponding nine months of 1909.

NEW YORK.

Market conditions continue bad; even excellent securities fail to tempt the general public. That this is not due to any lack of money is indicated by a recent Treasury statement, which showed that savings bank deposits on June 30 exceeded \$4,000,000,000 and during the year this sum had increased at a rate approximating a million dollars per day. The significance of this lies in the fact that the savings banks are patronized by wage-earners and men on small salary. The individual deposits rarely exceeds \$3000, and for people of small income to accumulate at such a rate at a time when the cost of living is undeniably high, indicates that fundamental conditions are good. It also shows that the "extravagance" of which so much has been said of recent years is that of the rich rather than of the poor. It is fear of loss that keeps the money in the savings banks, as is shown by the fact that these banks usually pay but 2 to 4% interest, whereas sound bonds are now selling at rates that net 4 to 6%. Making due allowance for differences in taxation, it is still evident that the average small investor counts the security with which savings banks have been surrounded by law as worth more than possible increased returns. Trading on the big and little exchanges, therefore, continues to be mainly professional and underwriting syndi-

cates are loaded with securities that the public refuses to touch. How long these conditions will continue cannot be foretold. The rank manipulation that has characterized so many flotations is evidently tending to cut off the source of supply of funds and ultimately it would seem that a national incorporation act and other proposed measures to safeguard investors must be adopted. In the meantime, some efforts toward better conditions are being made. The New York Curb has recently adopted new and greatly improved rules. The Post Office Department has raided a few houses that had become notorious for manipulation and for dealing in wild-cat stocks, and several States have enacted legislation designed to check abuses. The despised 'muck-rakers' have done much good by admitting the light of day and explaining to the erstwhile victims exactly how the game was played. More than this, however, is needed. There must be a better recognition of the essential unfairness and dishonesty of many of the practices that have been common.

Guggenheim finances.—The plan finally proposed for adjusting matters between the A. S. & R. Co. and the Smelting Securities Company is slightly different from that at first outlined and which I discussed last month. It is now proposed that the Smelters company shall pay its debt to the A. S. & R. by issuing to it \$15,000,000 in 6% debenture notes. Stockholders in the A. S. & R. Co. are to be given the right to subscribe to these notes and also to convert them at par into the common stock of the A. S. & R. To effect this a special meeting of the stockholders has been called for January 5 to ratify the issue of \$15,000,000 worth of additional common stock now paying 4%. That the scheme is not regarded with favour is indicated by the fact that convertible bonds of the Smelters company dropped from 104 to 100½ as soon as trading in them began and A. S. & R. rights sold for ¼. Both the A. S. & R. and the smelters company have extremely valuable properties and their business has been conducted with signal success, but it is evident that the rapid expansion of the Guggenheims has led to disappointment in individual purchases and also to a demand for more capital than could be supplied through normal growth of business. In calling for outside aid they have been unfortunate, their temporary alliance with T. W. Lawson, in particular, having injured their popular credit. It is also known that in certain directions the trend of business is against them. In lead smelting the practical monopoly of Colorado

is not now so important since rich silver-lead ore and high-grade silicious gold ore is not now so abundant in that State. The Colorado furnaces are running at half capacity, as was recently stated in an excellent address before the Denver Chamber of Commerce by Franklin Guiterman, manager for the A. S. & R. Co. in Colorado. In copper smelting the Guggenheims have had to meet new and strong competition, and altogether navigation of the Guggenheim ship has not been easy. Alliance with J. P. Morgan & Co. has cleared away many difficulties and with the abundant opportunities that come to such a combination any

Ballinger, for the present at least, remains as Secretary of the Interior and so long as he is in that position his recommendations regarding changes in laws governing mineral lands must carry weight. In his report, made public November 9, he recommended leasing rather than sale of the oil land and of coal land in Alaska. He also proposed that location notices should be filed in the land office and that claims should not be held more than seven years without being patented. A further recommendation was to the effect that not more than 40 acres be allowed any individual or association under the placer-land law. Public opinion



THE CON. VIRGINIA ENGINE HOUSE, ON THE COMSTOCK

embarrassment should be temporary only. A different system of financing, one that would inspire confidence rather than distrust on the part of the public, would be well worth adopting.

Whitewash has been applied again to R. A. Ballinger, the gentleman who refuses to be jarred loose from his position in Mr. Taft's cabinet. It is not the first time that Mr. Ballinger has been treated with the liquid with which Southern darkies are wont to cover unsightly houses and fences, disguising their structural defects and real uselessness. This time the majority of the Congressional investigating committee has come nobly to his rescue and affirms that he has been most unjustly accused by Mr. Gifford Pinchot and others. Nobody, however, pays much attention to the report, since the matter long since became so controversial that even a decision from the Supreme Court would lead but to an agitation for appointment of additional judges. Mr.

is much divided as to these matters. It is evident that the President will insist on some provision for lease rather than sale of oil, coal, and phosphate lands, and on other conservation legislation. It is not so certain that he will succeed in getting the desired laws enacted.

Bureau of Mines matters are in good shape. The new Director, J. A. Holmes, is proving both able and popular. He has taken pains to deny the rumour that Bureau of Mines and Geological Survey officials have had difficulties in co-operating and, indeed, the two bureaus are working together quite as they should. The new mine-rescue cars are proving effective in educating miners and operators regarding precautions necessary if mine accidents are to be avoided. Seven of these cars are now on the road. A series of systematic tests of mine cables, safety-clutches, hoists, and cage construction is to be taken up at Pittsburg. It is also proposed to make crushing tests on large blocks of coal, and later, on

vein-wall material, concrete and timber sets, and other structures, with a view to determining the factors of safety for underground work. These tests will be but the prelude to careful underground studies that should be of wide interest and much value. For carrying out this work the Bureau has available a 600,000-lb. testing machine and one of 10,000,000-lb. capacity. The latter was really planned to test the gates for locks on the Panama Canal but was never erected, since changes in the design of the gates made the particular tests unnecessary. It has been proposed to transfer the machine to the Bureau of Standards at Washington but it is too heavy to be transported and will be needed by the Bureau of Mines if the tests outlined are made. Plans for special work in the Western metal mines have not yet been announced, but as Mr. Holmes has been in frequent consultation with D. W. Brunton, Hennen Jennings, Gardner Williams, H. C. Perkins, F. W. Bradley, and other engineers of equal repute, it is evident that whatever plans are proposed will be sound and will deserve support.

DENVER.

Stratton's Independence.—The completion of the second unit of cyanide plant for the treatment of low grade dump ore at Stratton's Independence, Cripple Creek, was celebrated by a banquet, at which Philip Argall took the opportunity of comparing the high cost of treatment 16 years ago with the extremely economical methods now possible. Mr. Argall has good reason to feel proud of the excellent work which he has inaugurated. In 1894 the treatment costs were \$15 per ton and they are now only \$1'50, with a prospect of a further reduction to \$1'25 or even \$1'00; this, in spite of the remote position of the district away up in the mountains and the consequent high rates for transport of all supplies. Mr. Argall's speech contained interesting reminiscences and was full of infectious enthusiasm. Eighteen years ago he commenced his connection with the cyanide process by going to Deadwood, South Dakota, in the interests of the owners of the MacArthur-Forrest patents. At this spot in the Black Hills a cyanide plant had been erected and had proved a failure at first, and advice was required. His second trip was to what is now the Brodie mill at Cripple Creek, where the cyanide process was also a failure. In both these cases the ore was ground fine and could not be leached; this was in the days before slime agitators. Nevertheless Mr. Argall was firmly convinced that cyanide treat-

ment would be the most suitable for Cripple Creek ores, and by tongue and pen was persistent in his advocacy of its adoption. Indeed he then made a design for a treatment plant which was adopted 14 years later at Stratton's Independence. Toward the end of 1894 he built the first large custom-plant for the direct cyanidation of telluride ore, and in the following year he introduced preliminary roasting. This plant was that of the Metallic Extraction Co. at Florence. At the close of his engagement in 1901, the capacity had been increased to 10,000 tons per month, and the cost of treatment had been reduced to one half. His connection with Cripple Creek was renewed in 1907 when he was asked to design a plant to treat the dumps at Stratton's Independence. The gold content of these dumps was much less than the current cost of treatment, and it was obvious that some different method must be adopted. Roasting was out of the question. He found by experiment that 35% of the gold could be recovered by wet concentration, and that another 35% could be obtained by cyaniding the remainder. With this 70% recovery the cost has proved to be less than \$1'50 in a plant treating 7000 tons per month. This metallurgical improvement should have an important economic influence on the future of Cripple Creek and will make the beneficiation of the low grade sulpho-telluride ores a practical proposition.

Cripple Creek.—The Portland G.M. Co., the big neighbour of Stratton's Independence, is also meeting with success in handling low-grade ore. The new mill built by this company has been steadily treating ore since July 1 and is now crushing 8000 to 9000 tons per month. An additional 6-ft. Chilean mill and set of rolls has been purchased which, with more screens also to be put in, will permit 15,000 tons per month to be handled after January 1. The value of the ore now being crushed is \$2'50 to \$3 per ton, and the cost of treatment, including tailing loss, less than \$2. This cost will be reduced as the capacity of the mill is increased. The plant at Colorado Springs, handling high-grade ore, continues to give satisfaction. Shipments from the district for November were as below:

	Tons	Value per Ton	Total
Smelters	4,320	\$65 00	\$280,000
U. S. S. & R. Co.	15,010	22 00	330,220
Portland	10,000	20 00	200,000
Golden Cycle	24,550	20 00	491,000
Portland, Battle Mt.	8,750	3 50	30,625
Stratton's Independence	8,000	3 00	24,000
Wild Horse	1,350	3 00	4,050

71,980

\$1,360,697

The Cripple Creek district is already being benefited by the Roosevelt Deep Drainage Tunnel. In the Mary McKinney mine the water-level is falling 12 ft. per month and the shaft is to be sunk 100 ft. At the Portland the water is going down 3 inches each 24 hours though the tunnel heading is still two miles from the No. 1 shaft. From the mouth of the adit the water is flowing 5000 gal. per minute.

CAMBORNE.

The Rainfall during the last three months has been exceptionally great and is causing a severe strain on various pumping plants. Since the middle of October, 25 in. has fallen, as compared with $5\frac{1}{2}$ in., the average rainfall for the same period during the last fifty years. It is quite unusual for the pumps to have any extra duty placed upon them so early in the winter. February and March are considered the wettest months of the year. At Dolcoath just before Christmas part of the lower workings was under water. The extraordinary amount of rain will add greatly to the expense of pumping during the past half-year.

Treveddow.—This little mine is situated at Warleggan, near Bodmin, and in the much belated report for 1909, recently issued, it is stated that the working expenses (exclusive of lord's dues and rents) were 9s. per ton stamped, "which is probably a record for working expenses in any tin mine in existence." Of course, this low figure is largely due to the use of water power, which drives not only the battery, but also the dressing-plant and the pumps. The predominating mineral is tin, but some copper is also found in the shallow levels. The mine is sunk to 60 fathoms, and the yearly output of black tin for the past 10 years has ranged between 30 and 70 tons, the highest being 69 tons in 1901. In 1908, the Californian battery was increased to 15 stamps and now it is proposed to put the 40 Cornish stamps, previously in use, into order again, the water being utilized a second time after it has passed over the great wheel that drives the Californian stamps. An increased output may therefore be shortly expected. Such an increase is evidently necessary, seeing that the recovery for 1909 was only 13'64 lb. per ton. In 1907 it was 23'22 lb., and in 1908, 18'67 lb., so there has been a steady drop. The output for 1909 was 9094 tons of ore, and in addition to the tin recovered, 166 tons of copper ore was secured. The loss on the year's work, including £1168 for depreciation and £805 for debenture interest, was £2403, and this, added

to previous losses, makes a debit balance carried forward of £7584. The lords of the mine have agreed to accept a minimum rent of £100 per annum, instead of the regular dues, until the mine shows more satisfactory results, and this together with the anticipated increased output and consequent reduction in working costs, and the manager's forecast of an improved grade from present developments, makes the outlook more promising.

Park-an-Chy.—We hear that this property in the St. Day district has been acquired by Edgar Allen & Co. of Sheffield, who are also working Wheal Gorland, another sett in the same neighbourhood. The new proprietors will work the mine for wolfram, and we un-



Photo by R. H. L. Lee
Head Frame at New Shaft, Dolcoath

derstand that a good lode of this mineral is available.

Goss Moor.—The usual difficulties encountered in nearly every new mining enterprise have not been absent from this alluvial proposition, and the consequence is that more money is being raised to bring it to a profitable stage. Difficulties in getting the barge into position for economical working, in saving the tin, and finally in the choice of power, have resulted in a loss for the first few months, the cost per cubic yard having been 1s. 2d., as against an anticipated cost of 6d. Suction-gas as applied to centrifugal-pumping, has proved in the words of G. C. Lush "an absolute failure," and it has now been decided to remove the gas-engines and install a steam-

plant. When this new plant is in working order, it is anticipated that about 11 tons of tin per month will be recovered. The ground is valued, after exhaustive tests, at $1\frac{1}{2}$ lb. per cubic yard worth 1s. with tin at 8d. per lb. and the cost is expected to be about 6d., so a fair margin of profit is shown if these results are obtained, as Mr. Lush confidently anticipates. There is plenty of room for four plants on Goss Moor of the size of the first unit, which will treat about 10 acres per annum. Oliver Wethered has recently been elected to the directorate of this company.

National Minerals Corporation.—The chief interest in this report recently issued lies in the information given respecting its subsidiary undertakings, the St. Ives Consolidated Mines and the St. Agnes Consolidated Co. Respecting the former, it is stated that 10,000 milligrammes of radium have so far been produced, and a portion of this sold for £20 per milligramme. The stamp-battery on the Giew mine is ready to start, and it is anticipated that the company will shortly be selling black tin and thus materialize the rich developments in this section which have been reported by the management from time to time. As regards the St. Agnes group, the company holds a controlling interest in West Kitty, and is also prospecting above water level at East Blue Hills, it is said, with good results. It is expected that milling operations will shortly be resumed at West Kitty, and with tin at its present price, the earlier the better for the shareholders in the West Kitty company, who have had no official information respecting the working of the property since it was acquired by the Schiff interests early in 1910.

Botallack.—To place the company working this property on a sound basis, it is found necessary to reconstruct, as the response to the recent issue of debentures was insufficient to go to allotment. It is now proposed to reduce the capital to £100,000, in £1 shares, and to cancel all prior charges. The present holders of ordinary shares are apparently to find the new capital or to lose their interest, and such shareholders will be entitled to claim one share, with a liability of 15s. for every two now held, while the holders of the existing "A" shares will receive one new fully-paid share for every four such shares held now. The holders of the income bonds get shares of an equal value in the new company. If the whole of the new shares are taken up, the new capital will amount to £37,500, from which the company will pay off the liabilities

of its predecessor and the costs of the present scheme. With the balance, it is proposed to sink Allen's, or the new central shaft, a further 410 ft., the present depth being 790 ft., and develop the setts from below the old workings. Over £70,000 has already been spent by this company. The office of the company will be removed to the mine.

MELBOURNE.

The Bullfinch district is the centre of interest in Australian mining. Unfortunately the developments so far have not been of such a character as to justify the wholesale flotation or the extensive pegging over a stretch of country 60 miles in length. The incident of the moment is the rumour of salting at the Great Chaffinch mine. This is one of the earliest floated companies and the representative of the Adelaide directors was Mr. H. Arthur. He did some trenching work on the claim, and in one of the trenches he reported that he had found rich ore. To confirm this statement he took to the mine a party of journalists and in their presence the trench was worked and rich ore developed. This fact was recorded by the pressmen in the form of a certificate signed by the whole of the witnesses. On this certificate being published a great rush for the shares took place, and everything went as happy as marriage bells until the arrival of Mr. H. Greenway, who had been appointed mine manager. He visited the claim and on sampling the ore in the trench announced that he could only get 12 dw. over a width of 3 ft. and that the rich ore was contained in a streak from 2 to 3 in. wide. Before this, however, representatives had been sent by private speculators and investors to inspect the trench and their report was much the same as that of Mr. Greenway.

Mr. Greenway's next report was that he only got a trace of gold. Then Mr. Arthur went to the field with Mr. Creer and said that, while the size of the rich shoot was diminishing, the average pannings were high. The slump in the shares led the Stock Exchanges of Adelaide, Sydney, and Melbourne to unite in asking the Minister of Mines of Western Australia to send an officer of the Department to investigate. The Minister of Mines very properly refrained from doing anything of the kind, but he suggested an independent firm of mining engineers. Their representative visited the district, but owing to some mishap having occurred to Mr. Greenway, he left the mine without accomplishing the task for which he had been engaged. Mr.

Greenway had been asked by the board to facilitate Mr. Grut's examination, but at the time of writing no one knows what had become of him except that he left Southern Cross in a motor to go to the mine. Every-one is wondering what has become of him, as he is a man who cannot be suspected of a desire not to be present when his work was undergoing revision. Indeed he was anxious that an examination should be made by an outside engineer.

At the Bullfinch mine good ore is being obtained, but at the moment it looks as if it was a case of one swallow not making a summer. Of course it is too soon to speak definitely, but developments so far have been disappointing. There has been much smoke, but little fire, although in the market place the most has been made of every report that has come to hand. A small output of good ore is being made at the Bullfinch Proprietary mine, but it is too small to gauge the extent of the formation or its average value. Therefore for the present decision must be suspended in regard to the Bullfinch district.

Zinc Production.—The Amalgamated Zinc (De Bavay's) Co., which has developed the De Bavay patent for the treatment of zinc residue of Broken Hill, has now three units of its plant at work. Consequently capital expenditure is practically at an end. The company is earning large profits, and it is understood that the cost of treatment, exclusive of the purchase price of tailing and transport to the mill, has been reduced to 6s. per ton. This company, the Mineral Separation Co., the Zinc Corporation, and the Broken Hill Proprietary are the four great producers of zinc concentrate in the Barrier range. Nearly all of their products go into the hands of German smelters, British producers evidently not having the enterprise or the grasp of the situation to seek to acquire possession of the great wealth of the Barrier. They could have had it almost for the asking at one time.

In Queensland copper mining attracts most attention. The Mount Elliott Company is now producing and making large profits out of very high-grade ore. The Hampden Cloncurry mine is developing well. A big law-suit is pending in regard to a block of 80,000 shares in the Mount Cuthbert Company being sold by the Directors against the wishes of the representatives of an influential body of shareholders. The government of the State is proceeding with a £6,000,000 railway scheme which should give a great impetus to mining by

bringing districts that are lying idle, owing to the cost of transport, and give them every chance of becoming reproductive areas.

Victorian gold mining does not appear to be on the mend, although there were hopes earlier on in the year that this would happen. Alluvial mining is depressed and developments at Bendigo have not been sufficiently rapid to enable the mines there to add largely to their current outputs. The figures for the output of Victoria for the past eleven months of the present year compare with those of 1909 and 1908 as follows:—

	1908	1909	1910
Month.	Oz. Fine	Oz. Fine	Oz. Fine
January.....	46,143	40,756	52,057
February.....	57,732	40,175	42,229
March.....	58,786	75,489	64,370
April.....	35,838	49,611	30,622
May.....	69,682	44,465	49,980
June.....	61,253	71,209	56,283
July.....	46,625	42,616	41,218
August.....	63,726	54,182	45,040
September.....	65,164	52,309	55,583
October.....	61,845	59,897	47,609
November.....	31,074	46,498	29,542
December.....	78,134	69,465	—
Total.....	676,002	646,672	514,533

Mount Lyell.—An important strike of ore is reported at the Mount Lyell mine, Tasmania, where the diamond drill bore in the 1100 ft. level of the North Lyell mine has passed through 42 feet of 8% copper ore. This will add largely to the reserves of the mine and refutes the story that the orebodies were petering out at depth.

General.—Today the tendency among a large number of people in the Australian States is to belittle the mining industry. The reason for this is that the enterprise of the community has for the last four or five years been largely attracted to pastoral and agricultural pursuits. This has been caused by the break-up of the drought and the existence of high prices for primary products, such as wool, meat, wheat, and fruit. The result has been that money-making has been possible in these industries, and in many instances large fortunes have been won by those who have had the pluck to risk capital in either the purchase of land or in the pastoral and agricultural industries. There have been no such opportunities in the mining industry. The last big chance was in connection with the development of the treatment of the zinc residues at Broken Hill, and in the purchase, prior to the sensational advance in the price of metals some years ago, of the cheap stocks of the Barrier. Only a small body of Australian investors made money out of the opportunity

that was then presented. Since then the price of metals has gone down and the gold output of the country has fallen off, but the figures of the mineral industry for 1909, only now just available, show that the output of metals is still a very important element in the production of the Commonwealth. The total for that year was £23,368,530, as against £23,007,131 for 1908.

MEXICO.

Production in 1910.—The latest Government statistics relating to mineral production are those of mineral exports during the fiscal year 1909-1910: Silver, 76,349,121 pesos; gold, 42,636,399 pesos; copper, 26,170,727 pesos; lead, 6,808,465 pesos; antimony, 2,187,470 pesos; zinc, 1,150,558 pesos; other mineral substances, 1,218,176 pesos. The total is 156,520,917 pesos. Statistics of production in the calendar year will show increases in silver and gold compared with the export figures for the fiscal year. The advance in the price of the metal has stimulated silver mining in Mexico, and some of the principal producers have enlarged their mills. The increase in Mexico's gold output during the last few years has been remarkable; it has been due in large measures to the better extraction rendered possible by improved methods of cyanidation, and the development of copper mining, which yields gold as a by-product. The gold output in 1898-1899 was 18,450,885 pesos, and in 1908-1909 44,881,620 pesos. From 1903-1904 to 1904-1905 there was a gain of nearly 6,000,000 pesos, and in the next year the gain was over 8,000,000. While copper prices have not been encouraging, copper production has been well maintained. In the first 11 months of the year the Cananea Consolidated Copper Co. (Greene-Cananea), Mexico's principal producer, had an output of 42,453,000 lb., against 44,937,365 lb. in the 12 months of 1909. The December return will raise the total above that of the preceding year. The Boleo Copper Co., in Lower California, which sends its output to Europe, produced 23,405,683 lb. up to the end of October. Owing to scarcity of water for concentration during the long dry season, the Moctezuma Copper Co. (Phelps, Dodge & Co.) has failed to equal its 1909 production of 13,059 tons of copper. The Teziutlan Copper Mining & Smelting Co., of Puebla, which shut down after the slump in copper, to await better prices, blew in two 500-ton furnaces late in April, and has been operating during the greater part of the time since, but at much be-

low capacity. The Mazapil Copper Co., of Zacatecas, another important producer, has maintained its average in 1910. Notwithstanding the high tariff on zinc ores entering the United States, shipments from Mexico to American smelters have continued during 1910. The prevailing prices have left a margin of profit on high-grade products. Some Mexican ore has been smelted in bond, the spelter being exported. European buyers have taken some zinc ore, shipments having been made through the port of Tampico. At the request of zinc producers, with a view to encouraging the exportation of zinc ore to Germany and England, the National Railways of Mexico reduced the rates to Tampico and increased them to border points. Nothing has been done during the year toward the establishment of a zinc smelter in Mexico.

Oil Exploration has been in progress along the Gulf coast of the Republic. At the Juan Casiano field, in the state of Vera Cruz, the Huasteca Petroleum Co. has brought in two gushers and several flowing wells, and an 8-in. pipe-line has been built to the port of Tampico, a distance of 65 miles, at a cost of \$1,000,000. The Huasteca is a subsidiary of the Mexican Petroleum Co. of Delaware, a \$50,000,000 corporation that controls, through another subsidiary concern, the Ebano oilfields in San Luis Potosi, which have been producing for nine years. Supplies from the Furbero and other districts in the State of Vera Cruz have enabled the Pearson-Aguila interests to stop the importation of American crude oil for the Minatitlan refinery on the Isthmus of Tehuantepec. The Pearsons have a contract covering the present production of the Furbero district, which is owned by the Oil Fields of Mexico Co., and advanced over 2,000,000 pesos for the construction of a pipeline and railroad to the Gulf port of Tuxpan. Both were completed during the year. The Pearson-Aguila interests have been exporting refined oil to England, and recently closed a contract with Japanese interests for the delivery, during the next three years, of 5,000,000 cases of refined oil. The West Coast of Mexico Oil Co., in which English capital is principally interested, was recently organized for exploration along the West coast and has started drilling in northern Sonora, near Nogales.

Coal production in Coahuila in 1910 is estimated at over 1,600,000 tons, with more than 220,000 tons of coke. Production is confined almost exclusively to that State. Work is in progress at Barranca, Sonora.

PERSONAL

W. J. BARNETT was recently in France and Spain.

A. J. BEAUDETTE is mining engineer to the Grand Trunk Pacific Railway, at Winnipeg.

E. H. BRANDT, of Bainbridge, Seymour & Co., left on 21st ult. for Chihuahua, Mexico.

ALBERT BURCH was at Treadwell, Alaska, in December.

GELASIO CAETANI arrives in London on January 23.

FOREST B. CALDWELL has been appointed engineer in charge of the property owned by the Candelaria Company in Mexico.

J. PARKE CHANNING, who was recently in Michigan, has gone to Arizona.

GEORGE P. CHAPLIN, late manager of the Frontino & Bolivia mines in Colombia, is now in England.

R. E. COMMANS has returned from South Africa.

WALTER CURRIE was at San Francisco and then at Deadwood, South Dakota.

H. S. DENNY is here from Mexico.

J. V. N. DORR sails for New York on January 17.

F. H. HAMILTON is taking a short holiday on the Riviera.

JOHN HAYS HAMMOND, recently at St. Petersburg, is now in London.

W. PELLEW HARVEY has returned from India.

VICTOR G. HILLS has been examining tungsten deposits in Nova Scotia.

C. BARING HORWOOD leaves for Spain on January 15.

J. POWER HUTCHINS has been appointed resident engineer, at St. Petersburg, for the Russian Mining Corporation.

W. R. INGALLS has ceased to be editor of the *Mineral Industry*, and is succeeded by ALBERT H. FAY.

C. O. LINDBERG is superintendent of the Santa Gertrudis mine at Pachuca.

LINDSLEY & LIVERMORE is a new mining engineering firm with offices at 60 State St., Boston.

HENRY LOUIS has returned from Dunderland, Norway.

W. W. MEIN is at Washington.

C. W. MERRILL sailed for New York on January 7.

C. H. MUNRO is on his way from San Francisco to London.

R. C. NICOLAUS is making a tour through the tin region of Northern Nigeria.

FRANK W. OLDFIELD has opened an office at Bolaños, in Jalisco, Mexico.

E. H. C. OLIPHANT sailed on January 3 for Melbourne to assume the editorship of the *Australian Mining Standard*.

JAMES PARK is here from New Zealand.

W. A. PRICHARD, of Prichard & Wilkinson, has moved to Santa Cruz de Alaya, in Sinaloa, Mexico.

C. W. PURINGTON returned from St. Petersburg on December 22, and leaves again shortly for Chita, in Siberia.

T. T. READ sailed by the *Blucher* for New York on December 31, proceeding to San Francisco.

FORBES RICKARD has returned to Denver from Progreso, in Lower California.

L. D. RICKETTS is expected here from Cananea, Mexico.

WILLIAM RUSSELL is on his way from New York to join J. V. N. DORR, who is now in Paris.

HOWARD D. SMITH left on January 7 on his return to San Francisco.

ERNEST KILBURN SCOTT expects to go to New South Wales shortly.

S. F. SHAW has returned to New York from Costa Rica.

A. L. SIMON left on December 17 for Manhattan, Nevada.

EDWARD STABLES was in British Guiana recently.

E. O. THIELE leaves for East Africa in February.

S. J. TRUSCOTT, now in Sumatra, will return to London in February.

H. W. TURNER leaves in a few days to make a geological examination of the Kyshtim district, in Siberia.

SCOTT TURNER sailed from New York on January 7 for a tour in Europe.

J. B. TYRRELL has opened a branch office at Porcupine, in Ontario.

WALTER H. WEED has been at Butte, Montana, lately.

S. H. WILLIAMS sailed for New York on December 17.

METAL MARKETS

COPPER.

Average prices of cash standard copper :

December 1910.	November 1910.	December 1909.
£ 26. 18s. 1d.	£ 27. 18s. 3d.	£ 60. 1s. 0d.

Although the month has been distinguished by the settlement of the shipbuilding dispute there has been little encouragement to higher prices or improvement in demand. The continued unfavourable reports concerning the industrial situation in America, the election excitement here, and the general holiday apathy in both markets have produced a gradual decline in prices, and the end of the year showed a fall of about £2 during the month. Some encouragement should be found in the published statistics which show in Europe a steady if no longer rapid fall in stocks; and in America a slight decrease in production, which is surely the evidence of the curtailment policy; and also a decline of 4000 tons in stocks. The reduction since January 1910 of 28,000 tons in the published world's supplies combined with the enormous consumption still in full swing encourages belief in better times for the market.

Consumers have shown little disposition to buy, viewing the future with hesitation. Producers on the other hand have not followed the downward course of the market and have refused to lower their prices. The actual tonnage of transactions has naturally been small, but in view of the general trade activity this is not necessarily discouraging for the immediate future. When stocktaking is over an increased inquiry may be expected. The sulphate of copper trade is active and firm.

TIN.

Average prices of cash tin :

December 1910.	November 1910.	December 1909.
£173. 17s. 3d.	£166. 18s. 0d.	£149. 2s. 3d.

Tin continues to exhibit the same fluctuations which have distinguished it for a long time. The syndicate which has it so completely under control has succeeded, being favoured by excellent consumption, moderate supplies, and easy finance, in raising the price £12 during the month and so establishing a new record, during the present movement, of over £180. Violent declines follow every withdrawal of support, but the temptation for operators to take profits and to make bear sales soon produces an exhaustion of the market, that is invariably seized by the bulls to

establish higher prices. In the East good sales have been made to America, at full prices, and optimistic views are held by the sellers as to the immediate future of the market. Consumption is everywhere active and shows no sign of abatement. About Christmas the syndicate was suspected to be selling and prices declined; but this was followed by fresh activity on their part. At the end of the month a fresh shock was given by the announcement that the supply of Banka tin for next year would be increased by 1500 tons, which will counterbalance the supply from the Straits. This had an unsettling effect and prices closed at £174.

LEAD.

Average prices of soft foreign lead :

December 1910.	November 1910.	December 1909.
£13. 3s. 9d.	£13. 4s. 5d.	£13. 2s. 10d.

The usual dullness at this time of year has been increased by large arrivals of the metal in London, and by the forced sales of speculative purchases. Apprehensions of a shortage were induced by the floods in Spain, which prevented shipments, and prices advanced in consequence, but the advance did not last long.

SPELTER.

Average prices of good ordinary brands :

December 1910.	November 1910.	December 1909.
£23. 17s. 7d.	£24. 1s. 9d.	£23. 1s. 3d.

Business has been quiet. Transactions have been moderate with little inclination on part of consumers to buy. Prices have remained much at the same level during the month. Prospects for a large consumption during 1911 are considered good.

OTHER METALS AND MINERALS.

Prices quoted on January 10 :

SILVER.—25½d. per oz.

PLATINUM.—160s. per oz.

BISMUTH.—7s. 6d. per lb.

ALUMINIUM.—£67 per ton.

NICKEL.—£167 per ton.

COBALT.—9s. 9d. per lb.

ANTIMONY.—£29 per ton.

QUICKSILVER.—£8 per flask of 75 lb.

MANGANESE ORE.—8d. to 9d. per unit (1%).

IRON ORE.—Cumberland hematite 20s. per ton at mine. Spanish 21s. 9d. delivered in England.

PIG IRON.—Cleveland 50s. 1½d. per ton. Hematite 66s. per ton.

WOLFRAM ORE.—35s. 6d. per unit (1%).

DISCUSSION

Our readers are invited to criticize anything appearing in this magazine and to discuss other subjects of general technical interest.

Buying Water at the Price of Zinc.

The Editor:

Sir—Did you ever hear that story of the newly appointed director of a zinc-mining company, who made the greatest discovery of the age, namely, that the Swansea smelters had for 25 years been paying for water at the price of zinc? The story may have been told before, but it is worth repeating at the present time, seeing that several shrewd-enough business men and technologists have recently been entangled in the toils of the same paradox.

For years the company in question had been selling its zinc concentrate at Swansea, but the time arrived when it was considered desirable to ascertain whether better prices could not be obtained from German or Belgian buyers. The next parcel for disposal was therefore submitted to competition. The Swansea buyers, as usual, gave an all-round price for the concentrate as it stood, deducting 2% for wastage. Their figures were as follows:

Weight of concentrate.....	100 tons.
Allowance for wastage.....	2 „
Amount paid for.....	98 „
Price per ton.....	£6. 1s. 3d.
Total price.....	£594. 2s. 6d.

On the other hand the Belgian buyers first analysed the concentrate for moisture which they found to be 6%, and after assaying for metallic contents offered to pay for 50 units at the current price of the metal, £18, deducting £2. 10s. per ton as returning charge. Their figures were therefore:—

Amount of concentrate (wet).....	100 tons.
Amount of concentrate (dry).....	94 „
Price per ton £9, minus £2. 10s....	£6. 10s.
Total price.....	£611. 0s.

It was seen, therefore, that the Continental bid was more advantageous to the company by £16. 17s. 6d. Our director was indignant, considering that the Swansea people were making far too much out of the company; but on pondering the matter further he found that four tons of the parcel bought by them consisted of water, and that from this point of view they were actually paying four times £6. 1s. 3d. or £24. 5s. more than they should. Putting the two questions together he argued that though Swansea was paying £16. 17s. 6d. less than the Belgian firm, they were paying £24. 5s. for water, so that they made a net loss on the transaction of £7. 7s. 6d. His mirth and joy at discovering that Swansea had

been cheating itself for a quarter of a century was uncontrollable. As he said, Swansea buyers had been noted for their hard bargains, and were even known as 'screws.' But the state of things disclosed by his discovery was just too lovely for words.

After enjoying the situation for a fortnight, he was confidentially cornered by a co-director, a prominent man in the municipal life of the City of London, and the owner of a large fruit business, who told him that he was reminded of an incident in his youth. Two fruiterers went to Covent Garden to buy apples. The supplies available that morning were not of the best. Mr. Jones picked out the sound ones and bought 4 bushels at 5s. per bushel, paying in all 20s. Mr. Robinson had no time to pick and choose, so he bought 5 bushels at an all-round price of 4s. per bushel, intending to sort them out at home and throw the unsaleable ones away. This he did and consigned one bushel to the dust-bin. When Mr. Jones saw what he was doing, he said: "You blithering idiot! you paid 4s. at the market for that bushel of apples that you are now throwing away; you are out of pocket by that much." The moral of this is clear, continued the fruiterer-director, and is one of the elementary rules of arithmetic. If you buy several articles at various prices per pound, the average price will be greater than that of some of the articles; but you cannot say that you lose in the transaction just because you pay this higher average price for the articles of less value.

The zinc sale is, of course, not as simple as the apple transaction, because it introduces the willingness of one buyer to pay more than another as well as the question of the presence of water, both having an influence on the individual quotations. Our fruiterer-director proceeded to show that when the Swansea firm offered £6. 1s. 3d. per ton for 98 wet tons, they were really paying £594. 2s. 6d. for 94 dry tons, that is to say, at the rate of £6. 4s. 8d. per dry ton, as compared with the Belgian company's £6. 10s. The difference between £6. 1s. 3d. and £6. 4s. 8d. was the difference between the value of the wet and dry ore according to the Swansea computation. The difference between £6. 10s. and £6. 4s. 8d. represented the extra amount per ton of dry ore that the Belgian firm was willing to pay, they being either content with a smaller profit or being more expert smelters. As this reasoning did not impress the young director, his older confrere explained the matter from a different point of view. Conceding that the

Swansea firm was buying 4 tons of water at £60 ls. 3d., he proceeded to show that in this case the firm was getting 94 tons of dry ore at £60 ls. 3d. per ton, that is, for £5,692 17s. 6d., a decidedly substantial bargain. Still our adventurous director was unconvinced and brought forward other arguments with the object of proving that if he was wrong other people were wrong also. He said perhaps the water would not be there when the ore arrived at Swansea, or that perhaps the discrepancy was due to wrong sampling or assaying. He also thought that the 2% deducted for wastage might supply the key of the problem. Another of his suggestions was that the Swansea firm, though making a loss in buying the ore, relied for its profit on the returning charge, an argument which showed that he did not exactly know what a returning charge is. All these arguments have no bearing on the particular point upon which he went astray. They are like "the flowers that bloom in the spring," in that they "have nothing to do with the case." Whether he eventually understood the question, history does not record. The fact that others have since been mystified with the same problem shows that its explanation is not a simple matter.

EDWARD WALKER.

London, January 5.

Rusty Gold.

The Editor:

Sir—It is generally conceded that rusty and float gold, and gold that by association with base metals is not amenable to amalgamation upon plates, or in the ordinary riffles, will readily become amalgamated when in contact with a mercury surface excited by electricity.

A cleansing action is produced, nascent hydrogen being evolved from the water at, or near, the mercury surface. If the water contain salt, chlorine is liberated (a reducer and cleanser); thus hydrogen and sodium amalgam are formed. This cleansing action prepares the gold for amalgamation, no matter what its physical condition may be, even if greasy, preventing the mercury from 'flouring' and 'sickening.'

Electricity was applied with success at one mill I have seen in the United States in the form of a bridge of iron separated from the plates by a distance of $\frac{3}{8}$ in. and connected with one pole of a circuit, the plate with the other, the flowing pulp forming a contact. The whole mercury surface was excited, amalgam was used upon the plates, and regener-

ated from salt purposely added to the ore. Possibly galvanic action from the copper-iron couple might have answered as well without the aid of electricity.

Many years ago, while in charge of a mill in Victoria, Australia, I used the following method: A copper cylinder, extending almost the full length of the riffle, was immersed in mercury. The cylinder being hollow, with a central core of wood, it easily floated. Pressing against the ends were two copper strips connected to a continuous-current circuit. The flowing stream of pulp and water caused the cylinder to revolve, and all gold escaping the plates and free on floured mercury had to pass over and in contact with a freshly amalgamated surface of the cylinder. A current of low voltage but high amperage, 20-30 amp. per square foot of mercury surface, is necessary. This installation is simplicity itself and gives wonderful results, and I am of opinion that, if tried, many a cyanide plant would be rendered unnecessary. The idea would especially apply to fine ground material from Chilean, Huntington, or tubemills now passing direct to cyanidation, where coarse crushing by stamps without amalgamation previous to secondary treatment is practised.

ERNEST H. VAUGHAN.

Lavras, Brazil, November 9, 1910.

Martin's Process for Treating Refractory Ores.

—In the yearly report just issued by the National Minerals Corporation, it is announced that Martin's new process "of world-wide application" has been acquired and that subsidiary companies have been formed to work it. On looking through the Patent Office lists we find several patents granted to William Morley Martin of Redruth. The basis of these is that the oxidation of sulphides is effected by the addition of an oxidizing agent, for instance, nitrate of soda. The oxidation is not complete, but it is sufficient to make it possible to remove the iron, copper, arsenic, or other sulphide from tin or wolfram by water concentration. The process is intended as a substitute for roasting and is said to have the advantage of being more rapid than the latter. In patent 4531 of 1909 the nitrate is added in the form of solution and the damp mass is heated to a dull red heat. Patent 9300 of 1909 specifies the use of nitrate in the dry form, and 18,176 of 1909 shows that when a solution is used the reaction can be completed without heat. The value of this process will depend primarily on the price of nitrate of soda.

MORE ABOUT MEXICO

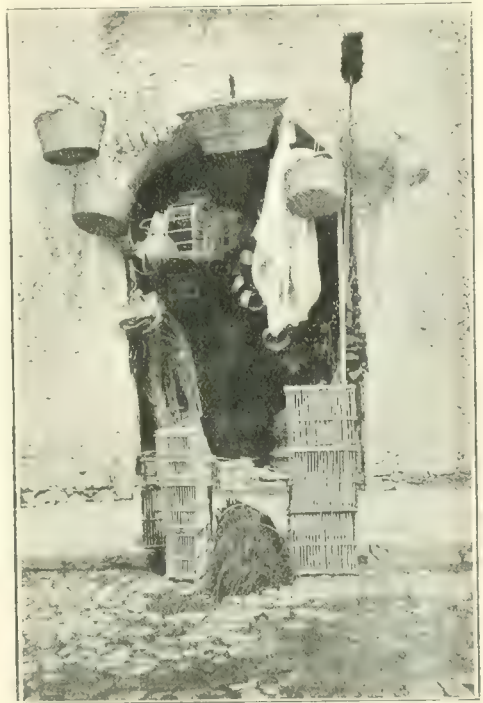
By THEO. F. VAN WAGENEN.

MEXICO is nominally a republic; actually it is a pure autocracy. But as the autocrat, Porfirio Diaz, happens to be one of the most tactful, sensible, and capable of men, his government has been, during the five terms of his incumbency, a remarkable and complete success in its way. For a quarter of a century Mexico has enjoyed tranquillity to an extent unequalled in the current history of the Latin-American race, and in that time material progress has been so great, and social

Actually there is no such thing as voting at all. All officials are supposed to be elected by the people, from the President down. There is a National Congress, and a legislature in each State. At intervals an election notice is published in the *Diario Oficial*. There are no caucuses, primaries, State or National conventions. Certain individuals are nominated by



In Leon de Mayo



Basket maker's shop

advance in many directions so marked, that any unfavourable criticism of the system might well be regarded as unwarranted. Among foreigners residing in the Republic the system of government is considered to have been, since Diaz took charge, exactly what the country and the people needed. One thing is certain, namely, for the alien, life, property, and the normal individual rights as understood by the most advanced nations of the day are as completely protected in Mexico as in any part of the world, and will remain so as long as Diaz lives. What will happen thereafter is a moot question. In Mexico universal manhood suffrage nominally prevails.

certain unknown powers for the positions to be filled. That is all. On the day set for the election the voting-booths are placed here and there, and tickets printed, but practically no voting occurs. Few know of the election, not even among the upper classes, and certainly not the lower. If an opposition candidate appears it is like a sporadic case of smallpox. In the *Diario Oficial* of the following day, however, the candidate selected by the invisible power at the hub of things is announced as having been elected by an overwhelming majority. No one ever reads the *Diario*. It is unknown to 99% of the people.

Periodically State and National legislatures meet, and in an astonishingly brief time bills are introduced, read, and passed. Recognized methods of procedure are rigidly followed, but there is little debate, few amendments, no interpellations, no committee work, no questions. Bills usually pass just as introduced. The legislatures exist apparently mainly to register in a formal way the measures decided upon by the power at the centre machine. Yet the wheels move, regularly, noiselessly, with little or no friction, and no one has a word to say openly in opposition. There is no such thing as newspaper discussion of proposed or completed legislation. When examined, each statute placed on the book appears to be of the nature of a mandate from the people through its elected law-makers to the Executive, authorizing him to accomplish certain results. In a broad way he is politely advised to operate along specified lines, and given explicit authority to arrange all details as may seem to him most wise. Later, when the new law goes into effect, the details, as finally arranged, will be published. If then a citizen of note, or a community of importance, or an interest that is strong, finds that the new law is oppressive, the Executive, or one of the Cabinet ministers is quietly interviewed, the subject is discussed calmly, and if it can be shown that the general purpose of the Government can be better accomplished by a change, the change is made then and there, and nothing more is said about it. It is a remarkable system, and it works marvellously well. It is a visible proof of the old saying that the best kind of a government is an autocracy, if the autocrat be the right kind of a man.

This, of course, is the weak point of the system. If the object of a government be to secure tranquillity and to conduct operations with a view mainly to forwarding the interests of the important individuals of the existing generation, then no fault can be found with the rule of President Diaz. But the highest ideals of the present day aim at the cultivation of the powers of self-government, the kernel or gist of which is the production of citizens who have learned by experience that the rights of each individual in a community are always bounded by the similar rights of all other citizens, that the good of all is a higher standard than the advantage of a few, that liberty cannot be understood, much less secured and preserved, except through education and the voluntary practice of morality, that, in fine, human society can only advance *en masse*, by the advance of its units.

It is impossible to study the citizen of Mexico today without coming to the conclusion that during the last quarter of a century he has made almost no advance in ideals. Among the upper classes there is no patriotism, while among the lower neither the idea nor the word exists. No foreigner, no matter how long he resides in the Republic, ever dreams of becoming a Mexican citizen by the process of naturalization. There is no such thing as individual, municipal, State, or National public spirit. The country is being exploited almost exclusively by the foreigner. Although material advance in wealth is notable generally, the people appear to possess no originality or distinctive character. They are simply adopting the ways, customs, and systems of other nations, and are producing nothing new of their own. All this is plainly due to the fact that having no hand in the government, having everything done for them by a beneficent autocrat, being called upon to do nothing but pay indirect taxes, which are not felt by the masses, and being denied all participation in the disbursement of the same, or even a knowledge of how they are disbursed, they have lost ambition, enterprise, initiative; they are as children. The Government provides all public amusements, such as theatres, parks, open-air concerts, fireworks, without aid or suggestion even from citizens of standing, and is selling to the foreigner in the way of concessions, as fast as he can pay for them, the right to exploit and own every material resource that a magnificent territory possesses. Perhaps they deserve such treatment. Possibly, as a people, they are not worthy to control their country; but who can say what possibilities exist among them? President Diaz cannot live for ever. He is an unusual man. He governs, not so much by virtue of the system he has inaugurated, as by the way he conducts and manipulates the machinery incidental thereto. He has no adequate successor in sight. It would be remarkable if one were available. Such men are not regular, but periodic, products. There is not one chance in a million that at his death a man can be found capable of governing as he has. What follows? The people during his *régime* have made no advance whatever in self-government, and when their beneficent autocrat is no longer on hand to guide and restrain, they will be like orphans, and no better fitted to manage their own affairs than when he took charge. This is inevitable. An even more unfortunate sequel seems to be imminent. After a quarter of a century of peace and com-

fort, a return to the old revolutionary days will be so distasteful to the upper classes who have acquired wealth and have learned how to enjoy it, that they are certain to join with the foreigner in the demand for peace at any price, even if that price be the extinction of Mexican nationality.

There are now nearly 10,000 miles of single-track railroad in Mexico. One can enter the country by rail across the international boundary at six points. At Nogales, in Arizona, the railroad continues southward through the

The other line leads off southwestwardly across Chihuahua and Sonora, and is aiming for Guaymas. The Central Mexican has numerous branches between Juarez and the City, two of which run to Tampico on the Gulf, and one to Manzanillo on the Pacific.

At Ciudad Porfirio Diaz begins the International railway, which crosses the States of Coahuila and Durango, and has for its objective the port of Mazatlan on the Pacific. At Laredo commences the National, which follows along the eastern side of the Mexican



OLD MINE BUILDINGS AT GUANAJUATO.

State of Sonora and down the west coast. At Naco a short line extends to the noted copper mining camp of Cananea in the northern part of Sonora. At Agua Prieta a line is being extended into and through the valley of the Yaqui river, with a destination at present uncertain. At El Paso, Texas, five American lines meet, and there, on the south bank of the Rio Grande, begins the Central Mexican, and the Rio Grande, Sierra Madre, and Pacific railroads. The former traverses the great central uplands to the City of Mexico and some 200 miles beyond to a point on the Balsas river, 80 miles from the city of Acapulco, one of the finest ports on the Pacific coast, and will in due time, no doubt, be extended to it.

plateau through Nuevo Leon and San Luis Potosi to the City of Mexico, with numerous branches to the east and west, one of which runs to Matamoras at the mouth of the Rio Grande.

On the Gulf coast are four main ports of entry : Matamoras, Tampico, Vera Cruz, and Coatzacoalcas. At Tampico lines of the Central Mexican lead off through the hot lowlands to Monterrey and Aguascalientes on the uplands. At Vera Cruz the Ferrocarril Interoceanico and the Ferrocarril Mexicano both run to the capital of the Republic. A third line called the Vera Cruz y Pacifico, bears off southeastward and then south to a connection with the Ferrocarril Tehuantepec. This be-

gins at Coahuila and crosses the isthmus at Tehuantepec to Salina Cruz on the Pacific. Besides these the Ferrocarril Mexicano del Sur runs from the large City of Puebla, about 100 miles southeast of the City of Mexico, through the State of Oaxaca to the city of the same name, and beyond it some 60 miles to Ejutla. This road is believed to be heading for a port at the mouth of the Rio Verde, about half-way between Acapulco and Salina Cruz. Finally, the Pan-American railroad, beginning at a station on the Tehuantepec line called San Geronimo, is now in operation to the border of Guatemala, and is planned to extend to Panama and beyond. By these roads it is now possible to reach with comfort and speed every city of any importance in the Republic. Finally the Kansas City, Mexico & Orient, is building across northern Mexico from Alpine on the Rio Grande, and is making for the port of Topolobampo on the Gulf of California. It has 300 miles in operation, with its present headquarters at the City of Chihuahua.

All these lines, except the Ferrocarril Mexicano, the first railroad built in Mexico and still owned largely in England, plus about 300 miles more in Campechy and Yucatan, have been constructed in the last 25 years, and under the presidency of Porfirio Diaz. It is a magnificent record, equalled in no other part of the world except in the United States. Pullmans are run on all those lines that are long enough to call for night journeys. Outside of these the ordinary aisle cars are employed, but there are first and second-class coaches and sometimes third, and the usual American style of mail, express and baggage cars. Passenger rates are extremely reasonable, being much less than on the Western American lines. All railways in Mexico have been built under concessions compelling the reversion of the roadbed to the Government at the end of 100 years or less, with compensation for rolling stock, buildings, and material on hand at the time of the transfer at equitable rates. The Government already owns a 51% interest in more than three-quarters of the existing mileage, but does not exercise its control except to establish maximum passenger and freight rates.

Mexican National bonds are above par, and stand deservedly high in all the money markets of the world. The revenues of the country are derived, first, from custom duties on imports, and second, from a system of stamp-taxation that bears almost exclusively on the producers or manufacturers of raw material, and on business transactions such as

licences, cheques, conveyances, and receipts. Thus the poor pay no taxes, so far as they are aware, though, of course, indirectly, in the enhanced cost of living, they pay a large part of them. Banks exist all over the Republic, being mainly branches of a few large and chartered institutions, though the business is open to all. The majority are solvent and with ample resources. It may be questioned whether the paper circulation afloat (about 120,000,000 pesos) is sufficiently secured to withstand a period of stress, especially since coinage of the silver peso has been suspended. The new gold coinage is coming slowly into circulation. The mining industry is in a flourishing condition, its yield for the year 1909 having been the equivalent of about £17,000,000. The total exports of the nation for the fiscal year ending April 30, 1909 (including precious metals) were £21,945,000. The imports for the same period were £17,365,000. Of the first figure more than 72% consisted of products of the mines, while 22% included raw agricultural products of a tropical nature, such as hennequin, coffee, rubber, bananas, and tobacco. Of the imports, manufactured goods constituted nearly 80%, while the balance was mainly modern prepared food. The well-to-do classes in Mexico are rapidly acquiring a liking for an up-to-date dietary, and have abandoned many of the staple foods of their past, but the bulk of the population live, as heretofore, principally on corn, beans, meat, and crude sugar. It is noteworthy that nearly 70% of the imports of Mexico originate in the United States, which also takes more than 70% of what Mexico has to sell. At the present time the total trade of Mexico is growing at the rate of about £8,000,000 annually.

The mining law gives ample protection to owners of mineral ground, though it does not offer much encouragement to the discoverer of new deposits. The manufacture of dynamite has been made a Government monopoly, a step the wisdom of which has been severely criticized. Manufacturing is growing fast under the high protective tariff. In some directions agricultural interests are growing, such as tobacco, coffee, cotton, hennequin, rubber, sugar-cane, and rice. In others, such as cereals, vegetables, and fruits, development is backward, and perhaps will never amount to much because of the aridity of the temperate part of the country. Merchandising is largely in the hands of German and French, though Americans are making notable strides in this direction.

OIL RESOURCES OF CALIFORNIA

By M. L. REQUA.

IN order to appreciate the importance of the oil resources of this State, it is necessary to know something of its distribution, its quantity, its uses, the markets that it may serve, and something of its cost of production, and its value in heat-units as compared with coal, with which it competes. Its value as fuel far exceeds its value for refining purposes, although the latter is neither insignificant nor unappreciated.

It is not possible on this occasion to enter into any detailed discussion of the geology involved, nor the theories of oil genesis. Suffice it to say that it occurs in California in sedimentary rocks generally of Tertiary age, and in sandstones, shales, and conglomerates. The general conditions favourable to the accumulation of oil underground are:

1. A formation of great thickness containing organic remains from which the oil is generated and from which it migrates and is concentrated in the formation that acts as a reservoir. I should place the minimum thickness of such originating formations at 1000 ft. These conditions are fulfilled in California in the Tejon shale and Monterey shale series wherein we have thicknesses up to 8000 ft.

2. A porous formation lying of sufficient thickness to contain the oil generated. These beds are usually of the same character as the present sea-sand, usually comparatively free from cementing influence and frequently coarse.

3. An anticlinal structure, which serves to concentrate oil and gas in the higher portions of permeable strata. Thus water accumulates in the lowest portions of the pervious sand and gravel strata, which form a natural reservoir. Oil being lighter, floats on the water and becomes concentrated either near the arch of an anticline, along the upper portions of a monocline, or in the outer limbs of a synclinal fold. Gas being still lighter, collects above the oil.

4. An impervious formation or capping of fine-grained shale or clay, in many cases interbedded with the various sand strata, but always overlying the oil horizon, and thus preventing upward migration and loss.

If added to this we have oil sand of sufficient thickness and saturation buried beneath the surface at a depth that can be profitably

reached by the drill, we have all the geological and commercial conditions necessary to a profitable oilfield. Those of California are usually in localities where there has been more or less folding and faulting, the outcrops being indicative of what may be expected in depth. In fact, the tracing of oil sand on the surface is identical with the tracing of outcrops of great metalliferous lodes.

Generally near the outcrop the yield is comparatively small, owing to the heaviness of the oil and the lack of pressure, due to loss of the lighter hydrocarbons by evaporation. At some point on the dip of the formation, conditions will become, in a large measure, constant, and thereafter to the commercial limit of depth we may reasonably expect a fairly uniform result both in gravity and production. Exceptions, however, are sometimes so puzzling that any hard and fast rule is not applicable. Heavy oil has been struck at great depths and below strata carrying lighter oils, so that actual development is necessary to justify any exact statement. Local underground conditions, as yet little understood, may, and probably will, cause variations both in thickness of sand, daily production, and gravity, but the average over any given district that has been well drilled will be found to be reasonably uniform. It is possible also to prognosticate in advance of development what an undeveloped area within these known limits may be expected to do, basing the estimate, of course, on what has already been accomplished in the territory already productive. It is not, however, possible to apply figures of one field to another field, save in a general way, as local conditions of sand, gas-pressure, and gravity of oil vary greatly, and it is quite likely that unexpected gas-pressure and saturation, or the lack of both or either, may upset preconceived theories.

Much money has been lost and great harm has been done by the novice assuming to judge of the possibilities of an oilfield in advance of development. Wells when first 'brought in' often yield a flush production for a short period and then settle down to a normal production. Estimating oil-land upon the basis of a single well during a few days of its life is not only misleading but is entirely unwarranted by the history of the industry. The Midway district

has in the Lakeview field the greatest oil and gas strike in the United States, but it does not follow that the territory from Sunset to McKittrick will produce a number of similar wells. Although it is now ten months since the Lakeview came in, and vigorous drilling has been done in the territory indicated, there has been no duplication of this well, and we may say that it is highly improbable that there will be another within the area indicated.

The accompanying map exhibits the various oilfields of California so far as developed at the present time. Between the Coalinga on the north and Fullerton on the south, are large areas within which it is quite probable that oil will be found in commercial quantity. I am, however, dealing only with known fields and reasonable extensions of the same, and it is not within my province to attempt to indicate the ultimate area over which oil may eventually be found.

North of Coalinga, there has, as yet, been no development giving promise of large production. Wells have been drilled in Alameda, Contra Costa, Colusa, Sonoma, Marin, Humboldt, and other northern counties, but entirely without success up to the present time.

The districts within this area may be tabulated as follows:

District	Name of Field	Proved Acres	Probable Additional Acres	Total
San Joaquin Valley	Coalinga.....	20,500	2,500	23,000
	Kern River	6,980	2,780	9,760
	McKittrick.....	2,670	3,840	6,600
	Maricopa Sunset ..	10,100	9,920	20,000
	Midway.....	12,000	64,400	82,400
Central	Santa Maria and Lompoc.....	15,000	5,000	20,000
	Other areas of low productivity.....	148	8,500	8,608
Southern	Fullerton - Whittier, Puente, and Olinda.....	4,760	38,120	42,880
	Other areas of low productivity....	31,040	60,240	91,280
		114,738	245,360	360,098

If we add to the total of 360,000 an additional 184,000 acres, we have a total of 544,000 acres, or approximately 850 square miles, as the total oil-bearing area of California. This is the estimate of Arnold, formerly of the U. S. Geological Survey, and I accept his figures for the reason that his study of California has been the most detailed and complete of any geologist.

The relative importance of these districts is shown in the accompanying table giving the production for 1909.

Field	Barrels
Coalinga.....	15,406,600
Kern River.....	14,508,292
Santa Maria, Lompoc, and Arroyo Grande.....	8,080,488
McKittrick.....	5,807,212
Fullerton-Brea Canyon.....	4,271,000
Salt Lake.....	3,821,233
Midway.....	2,234,456
Sunset.....	1,900,800
Whittier.....	848,800
Los Angeles.....	529,965
Newhall and Santa Paula.....	516,778
Summerland.....	66,300
Watsonville and Sargents.....	63,799
Puente.....	38,000

Total..... 58,191,723

For the year 1910 this total will probably approximate 75,000,000 bbls., which increase will come almost entirely from Midway, Sunset, and Coalinga.

Figures for the month of August 1910, are:

Field	Total Wells Producing	Total Production per Month
Coalinga.....	669	1,612,891
Midway.....	247	1,360,325
Kern River.....	1,582	1,281,695
Sunset.....	126	828,655
Santa Maria.....	135	776,550
McKittrick.....	166	508,373
Fullerton-Brea Canyon.....	234	438,617
Salt Lake.....	255	280,949
Whittier-Coyote.....	140	104,810
Lompoc.....	20	69,900
Santa Paula.....	248	41,584
Los Angeles.....	416	36,728
Newhall.....	71	14,613
Summerland.....	141	6,000
Puente.....	3	3,000
Watsonville.....	3	2,170
Arroyo Grande.....	2	900
Totals.....	4,509	7,368,320

It will be noted from the above that Midway in August produced 1,360,000 as against only 2,234,000 for the entire year 1909. These sudden changes are not uncommon in the industry and are the main reason for the violent fluctuation in price.

Turning again to the map, it will be seen that none of the oilfields are at any great distance from tide-water. Those near Los Angeles approach within 5 miles of the ocean and at the most remote point are not over 25 miles distant. In the vicinity of Ventura, from 15 to 30 miles will cover the nearest and greatest distance, and Santa Maria is not over 15 miles from the sea. In the Valley fields the pipe-line distances are as follows:

Localities	Miles
Kern River to Port Harford.....	150
Kern River to Port Costa.....	285
Midway to Port Harford.....	115
Coalinga to Monterey.....	108
Coalinga to Port Harford.....	110

Here lies one of the greatest advantages enjoyed by this oil region. Facilities for ocean

transport place California oil in a position that permits of its distribution over a wide territory and opens to it markets that otherwise would be beyond reach.

The United States Geological Survey has estimated the contents of the probable oil-

Of the minimum of ten thousand million barrels California is credited with one-half of the entire possible production of the United States and of the possible maximum California may possibly produce one-third. These figures, of course, are only intended to



lands of the United States, in barrels of 42 gallons, as follows:

Oilfield	Minimum	Maximum
Appalachian	2,000,000,000	5,000,000,000
Lima-Indiana	1,000,000,000	3,000,000,000
Illinois	350,000,000	1,000,000,000
Mid-Continent	400,000,000	1,000,000,000
Gulf	250,000,000	1,000,000,000
California	5,000,000,000	8,500,000,000
Minor districts	1,000,000,000	5,000,000,000

Totals . . . 10,000,000,000 14,500,000,000

express relative possibilities, for no calculations are practicable. They are, however, valuable in fixing not only the relative importance of various oilfields, but also in expressing in figures the opinions of geologists as to possible future production.

It is interesting also to compare the oil-bearing area of California with that of other parts of the United States, as shown in the accompanying list.

Alabama	10
Arkansas	80
California	30
Colorado	10
Florida	0
Georgia	1,000
Idaho	60
Illinois	60
Indiana	1,000
Iowa	60
Kansas	60
Kentucky	0
Louisiana	80
Maine	0
Massachusetts	0
Michigan	80
Minnesota	0
Mississippi	0
Montana	0
Nebraska	0
Nevada	0
New Hampshire	0
New Jersey	0
New Mexico	0
New York	0
North Carolina	0
Ohio	650
Oklahoma	400
Oregon	0
Pennsylvania	0
Tennessee	80
Texas	100
Vermont	0
Virginia	40
Washington	0
West Virginia	570
Wyoming	750
Total	8,450

According to this table the total area of oil-land in the United States is 8450 square miles. In other words, California is credited with slightly more than one-tenth of the total area, but is also credited with a quantity of oil equal to from one-half to one-third of the total. Analysis of the two tables gives, excluding California, a yield of approximately 1000 bbl. per acre as a minimum and something slightly over 3200 as a maximum. Contrasting this with the estimated California production of a minimum of 9000 to a maximum of over 15,000 bbl. per acre, we have a fairly satisfactory comprehension of the relative productivity, acre for acre, of the California land as contrasted with similar land in other parts of the United States.

In order to understand the problem, it is necessary to describe the method whereby the yield is computed. Sand as we know has varying voids up to approximately 42%. If the interstices have been filled with some cementing material there will not be the same oil saturation as in thoroughly free and coarse sand. The area of one acre is 43,560 square feet, so, therefore, in one acre-foot we may have a possible saturation varying from 0 to 35 or 40% of the cubic contents. If we had one acre-foot of solid oil we would have 43,560 cu. ft., and allowing $7\frac{1}{2}$ gal. per cu. ft., 326,700 gal. or 7777 bbl. of 42 gal. each, or 777,777 bbl. over one acre 100 ft. thick. If we now assume 7% of the bulk of the oil-sand to be oil that can be recovered, we have about 500 bbl. of oil per acre-foot of oil-sand as the commercial product. The question is one entirely of percentage of recoverable saturation, and because of the uncertainty involved, the factor

is purposely placed low. Percentages of saturation vary even in the same district, and between oil-strata in the same well. Sand-thickness varies from well to well as does gas-pressure. And it is impossible to prognosticate the relation of that greatest of all bugbears — water — to the oil. We have no guarantee as to when water will supplant oil; all we know is that the eventual fate of all oilfields is to be drowned by water, and while we know that such conditions in some localities are long deferred, yet we cannot calculate to the ultimate last barrel the production of a field with any assurance that water will not stop the production abruptly.

Water is of three kinds—top, bottom, and edge—and the problem confronting any oil-field is not that of top water so much as it is of bottom and edge water. Let us assume that the oil is resting upon bottom water and that at some point on the strike of the formation edge water will be encountered. In other words, the oil is enveloped on both sides, at the bottom, and on top, by water. The question of ultimate production is not so much a question of water displacing the oil, for the reason that oil so displaced by water seeks a higher point in the formation and in all probability is eventually recovered by wells near the outcrop, and on the edges, but it is necessary to know something as to the position of edge water and bottom water, for the reason that these two water strata definitely limit the quantity of oil contained in any given area. The position of edge water is easily demonstrated by drilling upon the strike of the formation, but that of bottom water is difficult of demonstration, for the reason that it lies at some point of extreme depth, and the history of all fields is that gradually, in the course of years, the wells creep farther and farther upon the dip of the formation and become deeper and deeper. Oil operators will not of their own initiative attempt the drilling of this deep territory until the shallower territory has been tested, so that it is, as a rule, impossible to predict where the line of demarkation exists between oil and bottom water. While it is true that water will drive oil from one portion of the field to another, it is also true that to the individual operator it may spell disaster, for the reason that the oil may be driven from his particular property to some other property.

Because of these uncertainties as to the exact position of edge and bottom water, it will be seen readily that any deductions as to the ultimate oil production in California are not susceptible of accurate expression in figures.

We can, however, without hesitation see sufficient production to guarantee the safety of the large investment necessary to make the oil commercially available, and give to the industry an assurance of stability, profit, and long life.

There are many localities showing sand from 100 to 300 ft. thick. In the east field of Coalinga a thickness of 400 to 500 ft. has been penetrated, and in Fullerton wells have been driven through not less than 1000 ft. of oil-bearing formation. Of this 1000 ft. in Fullerton it is hard to say what portion is actually oil-producing, but it is believed that most of the formation so penetrated is oil-bearing. In West Virginia, 5 ft. of pay sand is considered a safe estimate in productive territory. In Illinois, H. F. Bain places the thickness at from 2 to 30 ft., and in Texas, at Spindle Top, an average thickness of over 75 ft. has been calculated. In Pennsylvania the average production to date has been less than 800 bbl. per acre, and, according to David T. Day, it is fair to assume 1000 bbl. as an ample allowance for New York, Pennsylvania, West Virginia, Kentucky, Tennessee, Ohio, and Indiana.

In California the following yields are authentic:

Locality	Thickness of Sand in feet	Output in bbl. per acre	Yield in bbl. per acre foot
Sour Dough, Coalinga.....	60	96,000	1,600
Claremont, Kern River	250	93,000	330
Peerless, Kern River.....	300	84,000	280
Santa Fe, Fullerton.....	700	93,000	132

It is worthy of note that all of these properties are still active producers.

The production per well per day is also important. For the year 1907 the estimated yield in the various oilfields was as follows:

Oilfield	Bbl.
Appalachian.....	1'73
Lima-Indiana.....	2'74
Colorado-Wyoming.....	8'35
Illinois.....	8'37
Mid-Continent.....	5'29
Gulf.....	14'08
California.....	42'56

This does not, however, tell the entire story. An examination of the records over the period 1890 to 1908 shows the following:

Appalachian, a slightly fluctuating plus or minus from year to year, but over the period a constant diminution from 4'15 bbl. per well per day in 1890 to 1'73 bbl. in 1907.

The Lima-Indiana fields show a steady diminution year by year from 12'2 bbl. in 1890 to 2'74 bbl. per well per day in 1907.

Colorado-Wyoming from 28'07 to 8'35 bbl. per day.

Mid-Continent, an increase from 0'16 to 8'81 bbl. per day.

Gulf, an increase from 0'08 to 19'35 bbl. per well per day, with the maximum of 64'61 in 1905.

Illinois, 0'50 to 8'37 bbl., which latter is the maximum as compared with 3'30 bbl. daily in 1906.

California, 15'88 bbl. in 1890, 42'56 in 1907 and 50 in September 1910, per well per day. This has fluctuated as follows:

California Production per Well per Day			
1875	4'11	1900	9'15
1880	15'83	1905	33'49
1885	38'70	1906	34'07
1890	15'88	1907	42'56
1895	13'19	1910 (Sept.).....	50'00

The quantity of oil produced in California from year to year has increased with startling rapidity, as is shown herewith:

Total California Production			
Year	Barrels	Year	Barrels
1875	3,000	1893	470,179
1876	12,000	1894	705,869
1877	13,000	1895	1,208,482
1878	15,227	1896	1,252,777
1879	13,543	1897	1,903,411
1880	40,552	1898	2,257,207
1881	99,862	1899	2,642,095
1882	128,636	1900	4,324,484
1883	142,857	1901	8,786,330
1884	262,000	1902	13,984,268
1885	325,000	1903	24,382,472
1886	377,145	1904	29,639,134
1887	678,572	1905	33,427,473
1888	690,333	1906	33,098,598
1889	303,220	1907	39,748,375
1890	307,360	1908	48,300,758
1891	232,600	1909	58,191,000
1892	385,049	1910 (estimated)	75,000,000

It is not possible that this increase can continue in any such ratio over any long period. The neighbouring markets are now amply supplied, and to increase consumption, beyond the natural growth due to increased population, we must seek more distant markets with, incidentally, greatly added capital required to supply transportation facilities. There is reason to believe that California can find a market for 80,000,000 barrels annually within two years and 100,000,000 within five years. Beyond this it is at present hard to say, but I believe that 100,000,000 bbl. may be the ultimate high-water mark, and it is quite possible in the event of natural gas being piped throughout the State that the annual consumption will be somewhat less.

In view of the large investment required in pipe-lines, ships, tank-cars, and distributing stations, and the vital bearing the industry has on the prosperity of the State, it is interesting to theorize upon the probable pro-

distinctive life of the oil lands. W. W. Orcutt, Geologist of the Union Oil Co., has estimated that from known sources the State can yield 25,000,000 bbl. per annum for a period of 50 years. This makes 1,250,000,000 bbl., and Mr. Orcutt has pointed out that his estimate is confined to territory regarding which there is little doubt; in fact, it comprises largely the areas of the State from which production is already being derived.

Mr. Arnold, whose reports, published while he was a member of the U. S. Geological Survey, are the most exhaustive treatises extant, has estimated as a result of his investigations a total minimum of 5,000,000,000 and a maximum of 8,500,000,000. Assuming a mean of 7,000,000,000 bbl., we would have a yield of 70,000,000 per annum over a period of 100 years and it is possible, as I have already indicated, that provided the territory comprised in Mr. Arnold's estimate of 850 square miles is equally as productive as the territory already producing, we may have a total possible recovery of 11,000,000,000 bbl. with possibilities even beyond this quantity.

Extraction of Arsenic from Sulphuric Acid.—In our issue for September we referred to the method adopted by the United Alkali Co. for removing arsenic from sulphuric acid, a process which makes it possible to use arsenical pyrite in its manufacture. It was subsequently found that the arsenic present must be in the arsenious state otherwise the reaction will not work, so that if it is in the arsenic state it must be first reduced. The inventors have recently modified the process in such a way that the whole of the arsenic may be removed without preliminary treatment; this is described in British Patent 30196 of 1909. The old process consisted of blowing hydrochloric acid gas through the sulphuric acid and thus forming arsenious chloride which is easily separable. The new process depends on the fact that if hydrochloric acid is added in the right amount to a pentavalent arsenic compound it will reduce it to the corresponding trivalent compound; in the present case arsenious chloride is formed and chlorine gas liberated. Sufficient hydrochloric acid is therefore introduced into contact with the sulphuric acid to attack the trivalent arsenious compounds and to reduce the pentavalent compounds to the arsenious state and convert them into arsenious chloride. The remainder of the reaction is the same as before. Thus the whole of the arsenic can be removed in one operation.

The Rand Stope-Drill Competition.

The final report relating to the stope-drill competition held on the Rand during 1909 has at last been published. In our issue of February last year our Johannesburg correspondent gave an unofficial announcement of the results, and in July we published a résumé of the preliminary official report. The final report contains a carefully compiled history of drilling on the Rand and of the various attempts to introduce, by competition or otherwise, machines that can be used in narrow stopes as a substitute for Kaffir labour. It also contains exact descriptions and illustrations of all the competing drills. As we have already reported the Holman 2½ in. and the Siskol were the winners, being bracketed as equal, though their favourable characteristics differed, the latter being a more rapid driller and the former more economical as regards wear and tear. The report now issued states that one of the results of the competition is to prove that "machine-drilling in moderately narrow stopes costs no more, and perhaps even less, than hand-drilling by natives." Another conclusion is that hammer drills have no extended application on the Rand because they are not suitable for downward holes, which are the chief type of drilling operations there. Also it is stated that the terms relating to supervision and labour were not well chosen; a capable miner could supervise more than two machines, to which he was limited in the competition, and on the other hand, such two machines would require at least five natives. Under these circumstances it is suggested that a larger machine could be used without any increased amount of labour. From the more technical point of view it has been found that machines with short stroke are not as efficient as those with a longer stroke, because the latter give more clearance and are less liable to become choked by dust or dirt coming through the air-pipe. The committee was not in favour of the hollow steels used for introducing water, their high price and the difficulty of maintaining their temper being adverse circumstances. The competition did not reveal any new plan for placing the drills in position. The report should be read by everyone interested either in the use or the manufacture of machine drills.

The report refers at length to the various investigations into the relative value of machine and hand drills; this is a topic of interest because engineers in other countries have often made adverse criticisms of the employment of manual labour on the Rand.

NORTHERN MANCHURIA.

By C. W. PURINGTON.

THE portion of the Far East known as Northern Manchuria comprises the province of Hei-lung-kiang and the greater part of Kirin, or an area of nearly 300,000 out of the 360,000 square miles of all Manchuria. It has received but scant attention up to the present. For example, it is not generally borne in mind that previous to the discovery of America by Columbus, China possessed, as she still possesses, in that region which is now bounded to the south for a distance of 900 miles by the Chinese Eastern Railway and on the north for a distance of over 1000 miles by the Amur river, an area as large, as resourceful, and as fertile as Germany. This region extends from 44° 30' to 53° 30' north latitude and from 118° to 134° east longitude. It is reached on its southern border by the Trans-Siberian *train de luxe* and will soon be accessible from its northern side by the Amur railway. China possessed this land 500 years ago. She still possesses it, but development is as yet a thing of the future. There are, and have been, cities, such as Hailar, Tsitsikar, Mergen, Aigun, Harbin, Bayan-Susu, San-Sin-Ghen, Kalman, Ninguta. Outside of these the country is but little populated. Yet it is a flowery and wooded land; with broad valleys, traversed by 3000 miles of navigable rivers, some of them of great size, such as Ussuri, the Nonni or Nonula, and the Sungari; with extensive mountain ranges, which, from west to east, are the King, Big Kingan (called by some writers the Hsing-an), Ike-kuli, Ilkuri-Aline, Hailun-Shan, Little Kingan, Tun-ni-votzi, Kentai-Alin, Chakulan, and the Nadan-Hatala-Aline. Some of these ranges are more extensive and higher than the mountains of Europe north of the Alps, and all contain resources in timber, minerals, water-power and agriculture.

This is not the Manchuria of the treaty-port trader, the babbling missionary, and the plodding Chinese farmer of the south. It is the Manchuria of the cattleman, the Chefoo gold miner, the lonely packer, and the sable-hunter. For all the centuries of Chinese occupation, it has been and remains today the frontier, bearing much the same relation to Peking as did Scythia to ancient Rome, or as Montana, Colorado, and the district of the Great Salt Lake did to New York in the days of John Jacob Astor and the fur-traders.

How little this great portion of Manchuria, covering an area of over 250,000 square miles, is known or regarded by the self-appointed spiritual advisers of the Far East may be inferred from a conversation I held with a good missionary whom I met on my last trip westward over the Trans-Siberian, and who was introduced to me as a man who had been twenty years in Manchuria. Having some curiosity about the northern cities, I asked him about Mergen, on the great trading route between Tsitsikar and Aigun. He replied that he had never been or sent any ministers north of the Trans-Siberian railway, as he always imagined the country was populated with wild men. I did not continue the conversation as I was occupied mentally conjecturing just how wild a Chinaman must be before he ceased to be convertible by a missionary. The anecdote would doubtless be received with a grave smile in a circle of Chinese merchants at Blagoveshensk. Archibald R. Colquhoun in his 'Overland to China,' published in 1900, says: "No doubt the indefinite nature of our information as to the country is in great measure owing to geographical and political conditions, but it is also in part due to the lack of interest shown by Western peoples as regards Far Asia, and to the casual character of the expeditions which have from time to time been undertaken in Manchuria, for the most part accomplished by individual Englishmen and official Russians."

The solitudes of the mountain-valleys are not to be everlasting. The Russians with astounding magnanimity have built, and now with truly imperial disregard of cost operate a railway across Manchuria. What for? In one word: to help the Chinese to colonize Manchuria. China should honour the memory of Prince Hilkoff, the man who built the line. He built it well. As you pass the stations you see the evidence of warlike preparations in the past. All buildings are of solid masonry, and water-towers are built like forts, with loopholes for firing on besiegers. Companies of Russian soldiers are on guard at the stations and ride on the trains, along with their eternal bayonets. The passengers feel safe. Chinese officials travel first-class, and are received in state at larger towns by deputations of the Tongs, and the soldiers of the embryonic

Chinese army, in Japanese imitations of European uniforms. I once had the honour of serving as interpreter in order that the Governor-General of the province of Kirin, a pleasant old gentleman, might get his dinner in the Russian dining-car. Chinese immigrants fill the third-class cars and are all going somewhere. They are mostly bound for new lands and homesteads in Northern Manchuria. It is likely that the Chinaman sees a certain amount of humour in the whole situation, but he remains calm and inscrutable as ever.

An old and homely American phrase, used to indicate dense ignorance, says that a man "does not know beans." The Manchurian Chinaman, on the contrary, does know beans. He knows that the beans he grows on his rich land find a ready market; that, in fact, even now, in the third year of the bean business, the Chinese Eastern and the South Manchurian railways are energetically bidding against each other for the privilege of carrying the Chinaman's beans to the sea; that the ports of Vladivostock and Dalny are already crowded with shipping waiting to carry his beans to Europe. Beans, beans, thousands of tons of beans. Shipping agents at Liverpool, Hamburg, Bremen, and Antwerp, are wondering where they can get the ships to send to Dalny, to Vladivostock, and even to Nikolaievsk, at the mouth of the Amur, to receive the precious Manchurian cargo for next season. At Tsitsikar and Harbin the Chinese commission men are building great warehouses to receive the beans from the farmers, there to await the slow loading and transportation afforded by the Chinese Eastern railway. Barge after barge is laden with beans to be towed down the Sungari and Amur to Nikolaievsk, as the cheapest route to the sea. The beans are used in the manufacture of Soy (the basis of Worcester sauce, chutney, and other condiments), and of oil, the residue being utilized as a fertilizer.

As I write I am smoking Manchurian tobacco. It is good. Intensive cultivation will render it better. The tobacco business in Manchuria is in its infancy. 'Flor de Manchuria' may be among the cigars of the future. You can buy Indian corn at one penny per ear in the market-place of Harbin. In July, August, and September, the climate of Harbin would make Yuma, Arizona, seem cool. And on every side, as far as the eye can see, are fields of grain, wheat, rye, oats, and buckwheat. Regarding the agricultural products in general a writer in a recent issue of the *National Review* of China says: "Manchu-

ria is a splendid wheat country and both wheat and barley are widely grown, so that Manchuria supplies herself with native flour and with barley cakes." . . . "Rice is grown, not as in the South but in dry land, like other cereals. Maize (Indian corn), buckwheat and pearl barley, complete the list of cereals. Of far greater importance than any of these in the external trade of the country is pulse. A large variety of beans are grown in Manchuria, and together with their products, bean-cake and bean oil, they constitute by far the most important item in the export trade of Manchuria. The beans are of many kinds, the yellow, green, and black are varieties of the soya bean and each variety has sub-varieties. Besides these beans of commerce there are several varieties of garden bean cultivated for food. Two varieties of hemp are also found and they are proving paying crops, so that their cultivation is spreading."

This writer also calls attention to the growing of opium, tobacco, ginseng, all kinds of garden products, such as potatoes, turnips, radishes, carrots, garlic, onions, leeks, celery, brinjall, egg-plant, and cabbage, likewise varieties of timber, including vast, and in many cases, virgin forests of larch or tamarack, elm, oak, pine, walnut, birch, spruce, and plane trees.

The fur-bearing animals of Manchuria include the bear, wolf, fox, cat, leopard, otter, sable, squirrel, as well as the wild sheep and the tiger. Domestic fur-bearing animals are the dog and goat, which are 'farmed' so to speak, extensively. The curious industry of extracting medicine from the tender horns or 'panty' of the roebuck is an important one depending on the presence of wild animals.

The chief of the Bureau of Agriculture at Mukden is authority for the statement quoted by the British acting commercial attaché at Peking, that the present annual production of wheat in Manchuria is two million bushels, which might be increased to from 300 to 400 million bushels even with the primitive methods of native cultivation. He further says that the climate and soil are as favourable for the growth of wheat as in the valley of the Mississippi. The native wheats are chiefly of the bearded and smooth chafy type; but fife, blue stem, and Canadian Club types are also seen. Flour is produced by steam-roller mills at Harbin, Chang-chun, Hailar, and Kuan-cheng-tze under Russian management, at Ninguta, Aseho, and Kirin under Chinese, and Tiehling under Japanese. In 1909 5,400,000 bushels of wheat passed into

That at least is the rumour, which is improbable. That the colony existed in the mountains near the Amur river, there is no doubt. It is also likely that it was several times resuscitated and destroyed. There is no manner of doubt that the great ranges of northern Manchuria are gold-bearing. Yet the inhabitants, contrary to what might be supposed, are not miners, for such work as is done is in the hands of foreign Chinese who work under difficulties.

It is not easy to get anything approaching accurate information respecting the gold deposits of north Manchuria. The following list constitutes an enumeration of the localities best known, most of which are indicated on the map on page 55.

THE TUMEN.—Tributaries of this river contain gold gravel, as also do neighbouring creeks heading in the Mug-de-Kou range, which lies near the corner of Siberia, Manchuria, and Korea. The centre of this district is 40 miles north-east of the city of Hunchun.

THE SUNGARI.—Seventy miles east of San-Sin-Chen in the western end of the Nadan-Hatala-Aline range is an important region. Here the Hichir river, a tributary of the Sungari, rises in wild and unpopulated mountains, heavily timbered, and infested by some of the fiercest tigers in the world. Coarse gold is found in the streams, but the region is almost entirely undeveloped, as the Chinese placer-miners fear both the wild animals and the Manchurian outlaws.

TAI-PING-KOU and KUAN-YIN-SHAN, about half-way down the Amur river from Blagoveshensk to the mouth of the Sungari, are important Chinese gold-mining districts. The gold is said to be coarse and of dark colour and has been worked out in the higher gulches of the Fos-Kou and Mara ranges in which the streams rise. The gravel flats occupying the broad valleys adjacent to the Amur have never been exploited, however, and the region is jealously guarded by the Chinese authorities against possible incursion by wandering bands of Russians.

BLAGOVESHENSK.—A camp 15 miles north west of this city produces placer gold, but I do not know the Chinese name.

MO-HO or MO-HE.—This is the name of a Chinese government placer camp about forty miles east of the junction of the Shilka and Argun rivers, 20 miles inland, on the tributaries of the Emur-Albachi river. It is the celebrated site of ZHOLTO-HA. The streams rise in the foot-hills of the great plateau of Zhigichan, about 100 miles south of the Amur.

The alluvial gold of this region has been widely mentioned, but only the dimmest and most contradictory information is available concerning the topography of the country or the geological occurrence of the gold. The region comprises about 1000 square miles and includes probably the most important of all the north Manchurian placers.

This region is also cut by the river ARAKAN which flows west into the Argun, 35 miles southwest of its junction with the Shilka. The gravels of the Arakan have also been celebrated in Manchurian annals.

THE URGA, a branch of the Kang Gan, or Gin river, a tributary of the Argun, is the site of rich gravel. The locality is fairly accessible from the Trans-Siberian railway as it lies less than 100 miles northwest of the station 'Manchuria,' which forms the boundary point on the west between Manchuria and Siberia. The way lies over an alkali desert, however, so that any travellers must be well provisioned.

L. Putman Weale in his 'Manchu and Muscovite' states that the Government mines at Mo-Ho previous to 1900 produced, so far as could be ascertained, about a quarter of a million sterling per annum. This product was exclusive of what was extracted illegally in the Argun district of Hei-Laung-Chang province. Since 1900, it is understood, the official mining has been largely suspended.

NONNI or NONULA is a river which, both north and south of Tsitsikar, runs through an auriferous country, and many of its tributaries are worked by hand-sluicing. The Chinese Eastern follows one of these tributaries, the Yal, in climbing the divide of the Big Kingan west of Tsitsikar, and any traveller may note that he traverses a mineralized country. Near the summit station, Irekté (3270 ft.) there are many quartz veins to be seen in the schistose rock. Yet one may scan the hills with a glass and see no sign of prospect-holes. Weale says again: "The export of gold near the New-Chwang customs has sometimes reached several million taels in a single year, and the precious metal which finds its way out of the country in this manner only represents a very small part of the actual amount. China is reported to produce two millions sterling a year of gold and practically all comes from Manchuria."

Some attention may be given to the tales and romances of the Chinese coolies themselves who have wandered over Manchuria in search of easy gold-washings. All agree that northern Manchuria contains gold-bearing



TEMPLES IN NORTHERN MANCHURIA.



ANCIENT GATE TO MANCHURIAN CITY.

creeks and river-beds. All are equally unanimous that the conditions, both civil and physical, are very hard for the poor coolie, but predict a glowing future when once the 'pig-machines,' or 'rooting machine' as they call the dredges and excavators of the foreigners, begin digging in the Manchurian rivers.

For three years I have had in my employ the same class of Chefoo coolies who do the gold-mining in Manchuria. They are good miners after their fashion. They work with the short sluice and with the 'lotok' or wooden pan. These men know nothing of the improved methods in vogue among the Chinese in California. They are, however, intelligent, and many have at different times tried their lot in northern Manchuria. From their reports the region west of Aigun on the Amur river is gold-bearing, but is largely unexplored even by Chinese. The inhabitants of Manchuria have always been a lazy and truculent people. The Chinese are afraid of them. Safeguarded by no rights, and forbidden licenses or protection by their Government, the Chefoo placer miners prefer the districts of the upper Shilka, the Zea, and the Argun, where under the Russian law they at least have some measure of protection. But I also gather from them that both hydraulic and dredging conditions exist in the Ilkuri-Aline mountains, where the individual coolie cannot work at a profit owing to prohibitive physical conditions.

The information given above is interesting and the localities noted are for the most part worth a preliminary visit. The most valuable kernel of knowledge is that an area of 60,000 square miles to the west of Aigun, and bounded in the north by the navigable rivers Amur and Argun, totally unexplored by engineers, promises workable and perhaps rich placer mines. Its mountain valleys are cut by over a thousand miles of creeks and rivers. On the north it is hemmed in by a part of Siberia that for nearly a century has been celebrated for its gold and other mineral products. Five hundred miles in a straight line to the northwest lies Bodaibo, the centre of the richest placer mining district and the seat of the most productive gold mine that the world knows today.

Who will explore this vast region? Who will get the benefit of its resources? The Chinese, Chefoo and Tientsin men especially, are willing and intelligent labourers. They would gladly come in any number to supply the needs of a mining industry. Foreign capital and technical skill are not impossible to procure, could the proper rights be secured from the Chinese government. The bandits, the

Hun-Hooses (or Hunghutze), are of the past, and were always, I judge, largely a figment of the imagination. The region lies waiting. It is not of an isolated corner of the world I am speaking. It is of a domain fast coming within the arc of the search-light of progress. An English and American syndicate desires to build a railway from Chin-Chou north to Aigun, a railway that would develop Manchuria, especially the part which seems most worth developing. This project has been sanctioned by the Chinese government, and is favoured by the United States. The money is ready, as I understand it, to build this line. It would seem that China is the one to decide if the railway shall be built. And it would also seem that any objection on the part of foreign nations to the building of this line is in the nature of an affront to China. Such objections have been made by China's Asiatic neighbours, Russia and Japan, although no valid reasons against the project have been advanced. In conclusion, I venture to repeat that Manchuria north of the Chinese Eastern Railway is the most important part of that magnificent country; that it is a granary, a store-house of wealth and a prospective colony for the China of the south; that the construction of the line to Aigun is a necessary and acceptable part of the scheme of development and exploration.

Zinc Metallurgy. — In British patent 22704 of 1909 William Rees of Swansea describes an improved form of nozzle used for catching fume that escapes from the condenser. Instead of the old conical sheet-metal nozzle with open end fitting loosely over the mouth of the condenser, the inventor employs one of cylindrical form also made of sheet-metal. At the end nearest to the condenser it is made with trumpet-shaped edges so that it can be made to fit the condenser and the joint luted to be airtight, thus preventing admission of air and the oxidation of the zinc. The outer end is fitted with a metal cap which will give way whenever the internal pressure of vapour and gas suddenly increases, thus forming a safety valve to prevent the nozzle being blown away bodily. The nozzle is divided longitudinally into an upper and lower chamber separated by a perforated midriff. The upper chamber is filled with coke to catch fume, and has an opening at the top to allow the escape of gases into the atmosphere. Most of the heavier fume settles of its own accord in the lower chamber of the nozzle; as much of the impalpable fume as possible is caught in the coke above.

THE NORTH DUNDAS TIN DISTRICT

By J. M. BELL.

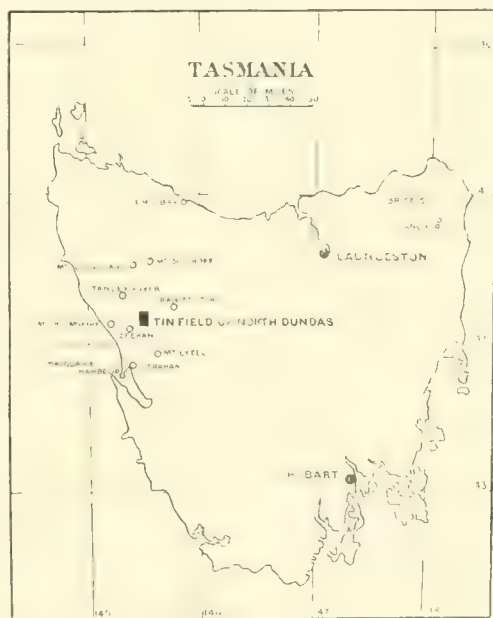
Introduction.—Perhaps no other part of the world of equal area contains a greater variety of mineral wealth than the rainy, storm-swept, bush-clad wilds of Western Tasmania. Though the locality is known chiefly because of the remarkable development, under well applied technical supervision, of the great Mt. Lyell property, it contains in addition the famous Mt. Bischoff tin mine, which, despite doleful prognostications a few years ago, seems now to be enjoying a new era of prosperity; the Zeehan silver-lead mining district; and many other smaller centres of profitable enterprise.

Popular interest at Zeehan is now drawn to the tinfields of North Dundas, lying in the valley of the Pieman river, some nine miles northeast of the town of Zeehan. Though the gravels of the Ring and Argent rivers, both tributaries of the Pieman, have been worked for upwards of 16 years for alluvial tin, it has only been within the last few years that there has been any attempt to develop the widespread tin-bearing lodes, whence the cassiterite of the alluvium was derived. In fact, the gossanous outcrops of the lodes were, during the boom days in Zeehan, originally staked as silver-lead claims.

General Geology.—The topography of North Dundas exhibits a hilly country, for the most part densely forested and deeply dissected by numerous streams. The alluvial flats in the valleys are narrow and unimportant. The geology* is complex. The prevailing rock consists of highly corrugated argillite and greywacke, supposedly Cambro-Ordovician. Partly contemporaneous with these and partly younger, are effusive and intrusive quartzose porphyries. Later came a series of basic rocks (*a*) gabbro and norite, (*b*) pyroxenite and peridotite. The former are in places metamorphosed into amphibolite, and the latter are almost everywhere changed into serpentine. Younger than the basic eruptives are dikes of quartz-porphyry, which has a strong genetic connection with the occurrence of the tin and is thought to be of Devonian age. The youngest of all the local igneous rocks is diabase. Extensive gravel, of supposed Pleistocene age, which is almost everywhere stanniferous, occupies fairly widespread local areas in the basin of the Pieman

and in the lower valleys of the Ring and the Argent.

The Ore.—There are two apparently distinct associations of minerals in the North Dundas lodes, namely, a quartz-tourmaline-cassiterite facies, and a pyrite-cassiterite facies. Lodes of the former type are limited to the immediate vicinity of the principal quartz-porphyry mass, and where found within the dikes of quartz-porphyry they form highly quartzose reticulating veins. The felspars of the quartz-porphyry itself are silicified, tourmalinized, and even replaced by cassiterite.



The pyrite-cassiterite type of vein in the argillite and greywacke is much the more common, and represents the facies that at present is being most developed. The chief minerals are quartz, pyrrhotite, pyrite, arseno-pyrite, and cassiterite, with which in places are associated chalcopryrite, galena, and other minerals. The unoxidized ore is frequently fine grained, and in appearance resembles a hard dense greywacke. Its metallic constituents are scarcely, if at all, apparent. Pyrrhotite is the prevailing sulphide. With complete oxidization the cassiterite becomes much more evident, showing as single grains or segregations, generally associated with much crystalline quartz.

* 'The Tinfeld of North Dundas,' Geological Survey of Tasmania, Bulletin No. 6, by L. Keith Ward.

Where less oxidized, it is not infrequently shrouded in limonite formed from the iron sulphides.

It is noteworthy that the argillite and grey-wacke are everywhere silicified in proximity to the tin lodes, and that they lack the carbon constituent so conspicuous elsewhere.

The Lodes.—Owing to the limited amount of development so far completed underground, it is difficult to hazard any hypothesis as to the structure of the lodes. Apparently, however, the mineralization in the sedimentaries has taken place along zones of shattered country, and thus have been produced extremely irregular lodes, developed along fractures crossing the bedding-planes of the sedimentaries and with branching veins therefrom parallel to the stratification. Fringing both the cross-stratification veins and those parallel thereto, called 'floors,' are zones of highly silicified argillite or greywacke, impregnated with cassiterite, through which ramify in all directions stringers and threads of vein-material.

Principal Properties.—The principal claims at present operated are the Renison Bell, the Boulder, and the Montana, but there are many other smaller properties. It seems probable that much better results would be attained by an amalgamation of small interests. At present a large proportion of the ore being treated by these several companies is of detrital nature, that is, material formed chiefly by the degradation of the zones of tin-impregnated argillite, and of the lodes themselves. This residual ore is protected from denudation by the thick coating of vegetable material, which almost everywhere clothes the hills. The Renison Bell company is working the gossan of one of the lodes on its property and sending the product to its mill.

Method of Treatment.—At present much of the tinstone is extracted merely by sluicing, water being brought in high-level races and from these tapped at various places, and run down the hills into launders. The coarser tin having been caught in riffles, the tailing is elevated by water-wheels, screened, then settled in spitzkasten, and passed over rotary tables and 'strakes.' It is finally concentrated in a 'kieving tub' before marketing. Obviously this method procures only the richer and in general finer ore.

The treatment in the Renison Bell mill may briefly be described. The ore is first passed through jaw-crushers, whence it goes direct to the stamps, which weigh 1 000 lb. each. Later it is further comminuted in Forwood-Down grinding-pans. From these the pulp is settled

in spitzkasten. On leaving the settling-tanks the spigot product passes to Card tables, and the overflow to Lubrig and Weir-Meredith vanners. On this varied apparatus much of the cassiterite is concentrated and removed. The middle product from the tables is returned to the grinding-pans, while the tailings from all sources are passed over canvas strakes. The final concentration of the first products is by agitation in the Cornish tub.

Output.—According to the return by W. H. Wallace, Secretary for Mines, Tasmania, for the quarter ending June 30, 1910, the statistics in regard to the output of tin concentrate from the various companies, and the number of men employed, were as follows:

	Tons	Men Employed
Boulder.....	27'25	18
Renison Bell.....	40'5	55
Montana Tin Syn...	13'43	34
Various Claims.....	6'55	28
	87'73	135

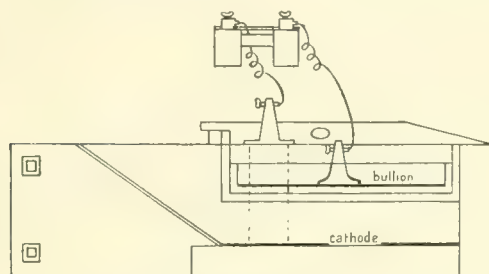
Prospects.—Until the North Dundas tin-field has been more extensively explored beneath the surface, its potentialities can be but a matter of surmise. To the most casual observer, however, it must be apparent how extensive is the mantle of detrital material, containing remnants of ore, on the hills. Good profits have already been derived from this source by many operators. The Montana claim has in all, it is said, obtained £18,000 worth from the detrital material without treating any ore from beneath the ground, and other claims have done proportionately well. The detrital material is, moreover, easily treated, and a fair proportion of it has already been removed. Thus future interest will centre mainly on the mining of the lodes and of the tin-impregnated country adjacent thereto. The ore of these deposits will not, except in unusual occurrences, be so rich a source of revenue as the naturally concentrated detritus. Moreover, its treatment, mining and milling, will be more expensive than that of the detrital ore, most of which is easily raked from the surface and requires little crushing.

At a shallow depth the oxidized ore is replaced by pyritic ore. It is thought, however, that the treatment of the sulphide need present no great difficulty, as it is likely that the tin itself will continue to be found as oxide.

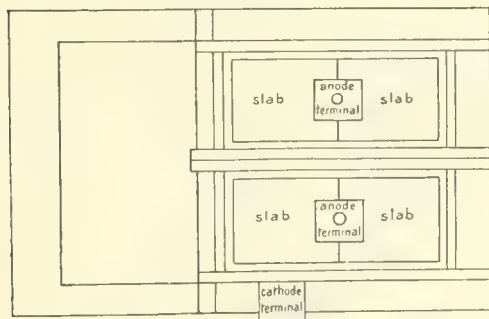
Mining beneath the surface offers reasonable chances for development, while the district presents good opportunities for the investment of capital in sluicing operations.

PRÉCIS OF TECHNOLOGY

Refining Gold-Silver-Slime at Waihi.—In the *Australian Mining Standard* for October 26, J. G. Goosman describes the processes adopted for refining the cyanide-bullion and for parting the gold and silver at the Waihi mine, New Zealand. The mills treat 35,000 tons of ore per month and the yield averages $\frac{1}{2}$ oz. gold and $4\frac{1}{2}$ oz. silver per ton. The bullion-slime is extracted from the zinc-boxes once a week, and after being partly dried by means of a vacuum, it is transferred to pans, measuring 18 by 12 by 10 in. and calculated to hold anything up to 140 lb. These are weighed so as to get an idea of the amount of zinc present. If they weigh less than 120 lb. they are sent to wooden vats 9 ft. diam. by 6 ft. deep and a 10% solution of sulphuric acid added. An hour's agitation dissolves the zinc. The vats are covered and



Vertical Section.



Plan of Electrolytic Cell.

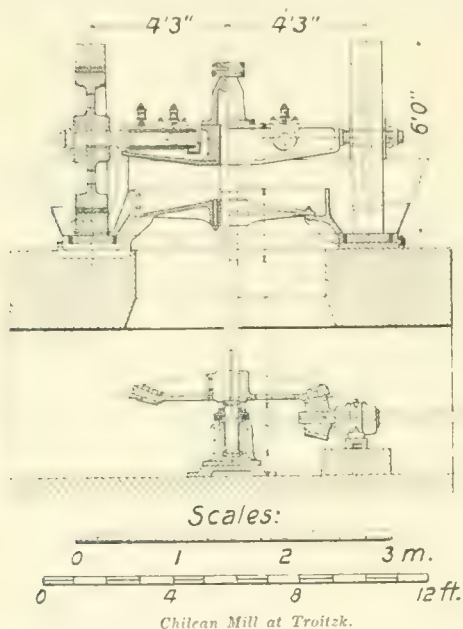
it is probable that the company will revert to pot melting, using 20% borax and 10% soda, followed by cupellation of the bars. The gold-silver alloy obtained is cast into plates measuring 10 by 8 by $\frac{3}{4}$ in. and weighing about 200 oz. These are sent to the new electrolytic parting plant recently erected. There are 30 cells each holding about 10 gallons of a dilute solution of nitric acid (0.6%). A frame covered with filter cloth is suspended in the electrolyte of each cell and upon this rests four slabs as shown in the drawing. Two anode terminals are placed in contact with the slabs. The cathode consists of a slab of silver with an area of 4 sq. ft. and $\frac{1}{4}$ in. thick and fitting the bottom of the bath; it is connected with the cathode terminal by a thin silver ribbon 4 in. wide passing up the wall of the cell. The current used is 100 amperes, at an average of 95 volts or $3\frac{1}{2}$ volts for each cell. The voltage varies with the resistance, being lower when the solution becomes warm, and also as the silver is deposited on the cathode. The precipitated silver is removed by means of wooden scrapers, and after washing to remove the acid is melted in plumbago crucibles. The gold and the scraps of bullion are caught on the filter-cloth and are washed through a 10-mesh sieve on to a filter. The fine black gold is washed and then boiled in a cast-iron kettle for three hours in concentrated sulphuric acid, for the purpose of dissolving the silver from the small particles of bullion that pass through the sieve. The fume coming off is passed through a flue in the hood of the kettle and is forced by means of a jet of steam through a coke condenser and subsequently to a wooden fume-stack. After this boiling the gold is sent to a filter and washed until the filtrate gives no precipitate with salt. The silver in the wash water is precipitated with scrap iron, and occasionally collected and returned for refining. The gold is then melted and cast into 1000 oz. bars. The silver sulphate produced in the kettle is used over again and when sufficiently concentrated is ultimately sent to lead-lined boxes and the silver precipitated by iron. The solution of silver nitrate from the cells is treated with salt and the silver chloride produced is removed to kettles lined with enamel. Here the silver is precipitated by zinc, sulphuric acid being added to hasten the reaction.

Production of Zinc direct from Blende.—F. Thomas in *Metallurgie* for November 22, gives an account of experiments undertaken for the purpose of obtaining electrolytically metallic zinc in a liquid condition direct from fused blende. For this purpose various fluxes were investigated, one of which consisted of a eutectic mixture of equal parts of potassium and sodium orthosilicates (R_4SiO_4), solidifying at $743^\circ C.$, together with 6% of manganese silicate, which caused the solidifying point to fall to $700^\circ C.$ The solubility of zinc sulphide in this flux at $900^\circ C.$, the highest temperature permissible, amounted however only to 0.5% and the low rate of solution was prejudicial to a smooth working of the electrolysis. A similar experiment, when zinc sulphide was electrolysed with an iron anode in a flux of sodium sulphide and iron sulphide to which sodium sulphide was continually added, proved equally unsuccessful. In both cases, a large proportion of the zinc on separation at the cathode passed into the form of dust. To remedy this defect the addition of lead sulphide to the sulphide flux was tried, but the only action of the lead compound was to decrease the fluidity of the bath. Even when an increased temperature with corresponding increase of pressure was employed, a coherent zinc could not be obtained, probably in consequence of the irregular heating of the charge which permitted a volatilization of the metal.

flues are provided by means of which steam jets withdraw any poisonous gases such as hydrocyanic acid and arseniuretted hydrogen. The vats are then filled with hot water and after the slime has settled the solution of zinc sulphate is decanted. The slime is then washed and partly dried, and returned to the smelting house where it is mixed with the higher-grade slime that weighs more than 120 lb. per pan. All the slime is tipped upon a mixing board and 30% by weight of borax added. In order to thoroughly mix, the mass is passed through rolls. It is then spread upon trays 3 by 2 ft. by 4 in. deep and sent to a drying oven. The method of smelting is now in a transition stage. Melting and cupelling in a 'test' was recently adopted instead of melting in plumbago pots followed by cupellation. Owing to the difficulty of finding a suitable material for the manufacture of 'tests' capable of withstanding the corrosive action of the borate slag,

and was heated in the form of slabs in the cold walls of the furnace. Finally, in a modification of the process, the ore was stamped and the sulphide was heated in a rotary kiln. The ore was heated for some time at a constant temperature not greater than 460°C. But the experiment proved unsuccessful, since the reaction between iron and zinc sulphide apparently requires a much higher temperature.

Chilean Mills in Russia. At the December meeting of the Institution of Mining and Metallurgy, H. C. Bayldon read a paper on the development of amalgamating plant in Russia, and also described an improved form of mill erected at the mines of the Troitzk Goldfields Limited in the Kotchkar district of Orenburg. He is the manager of these mines, and Hooper, Speak & Feilding are the consulting engineers. His introductory remarks on the history of vein mining in Russia are interesting, for they show that even so late in the day as 1867, when vein mining first commenced in the Kotchkar district, the miners had apparently no



knowledge of practice in other parts of the world, and devised crushing and amalgamating plant for themselves from first principles. At first the ore was placed on public thoroughfares and crushed by the ordinary traffic; then circular tracks were built and carts laden with stone drawn over the ore spread upon them. The first stamping was done by a cast-iron tipping hammer, which was afterwards superseded by gravity stamps giving from 4 to 6 blows per minute and operated by horses. Stone edge-runners were introduced in 1870. These were 7 ft. diam. and 18 in. thick, and were mounted on a horizontal wooden axle. They ran on stone slabs and were driven by horse-whim. Cast iron was soon substituted for stone and steam for horses. Up to this time the crushing was done first and amalgamation afterwards. About 1880, wet amalgamation in the pans was adopted. It should be noted that these mills though of the Chilean type are slower running than those usually associated with this name and used for special regrinding purposes. The standard Russian type is from 7 to 10½ ft. diam. and the

number of revolutions is never more than 4 per minute. The weight of each runner is usually 5400 lb. and its width 10 in.; the screen aperture is 1 mm. slotted; and the duty is from 16 to 26 tons per 24 hours. The author estimates that the power required is from 7 to 12 hp. It is remarkable how this type of machine has obtained a vogue in Russia, to the exclusion of stamps.

The author then proceeds to describe the plant erected at the mines of the Troitzk Goldfields. From the cross section of the mill given herewith it will be seen that the runners are driven from below. The grinding track is made narrow so that less percentage of weight has to be scrapped when the die is worn. The sides of the pan widen above the grinding track, thus ensuring a sufficiently forcible wash of water to carry the fine particles out of the mill as soon as possible. The screen is 44 in. wide by 8 in. deep. The amalgam is removed through an opening 24 in. wide usually closed by an iron slide at the back of the mill. The runners are 72 in. diam. and 12 in. thick; the total weight of each is 10,000 lb. and that of the tyre alone is 6040 lb. The set of dies weighs 4880 lb. The rate of revolution is 14 to 16 per minute. The capacity is 39 tons per day. The author does not specify the hardness of the ore. The installation contains 6 mills and they are driven by two motors each of 50 hp. Two copper amalgamation plates 4 ft. in width and 10 ft. long are used in connection with each mill. It is found that approximately 75% of the amalgam is obtained from the mill during clean-up, and the remainder from the plates. The author's experience is that this type of mill gives a remarkably even product, that it uses less water than stamps, that its mechanical efficiency is high, and that it requires little skilled supervision. In the paper the author gives much information relating to the results obtained in practice.

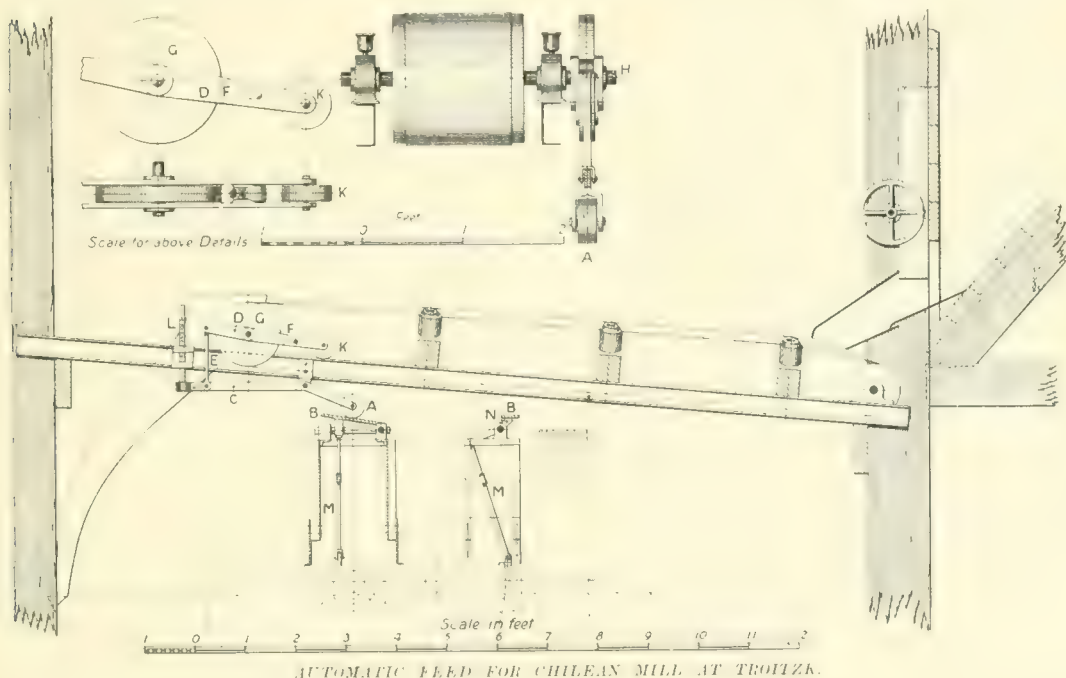
Most of the mills in Russia use Challenge feeders which are not quite suitable, so the author in conjunction with S. J. Speak designed an automatic belt-feeder which has given good results. At every revolution of the mill, the roller (A) is pressed upward by the slide (B), and by means of the levers and rods (C), (D), and (E), the claw (F) is made to engage with the friction wheel (G) and push it forward. This wheel is keyed to the shaft (H) which carries the pulley for driving the feed-belt. The belt is thus moved forward with each revolution of the mill. The roller (A) is brought back into position by the weight (K) attached to the end of the lever (D). The length of each movement of the belt is determined by the screw-spindle (L). If the feed is not equal to the discharge from the mill, the runners will gradually assume a lower plane of revolution, and a device is provided to automatically increase the rate of feed. The tie-rod (M), connected with the sleeve of the runner, is pulled down as the level of the runner sinks and causes the lever (N) to move upward and give a sharper inclination to the slide (B). The effect of this is to increase the stroke of the lever (C) and thus to hasten the travel of the belt.

Leaching Copper Ores.—During the last few years the fume question has been such an annoyance to copper smelters in the United States that several metallurgists have turned their attention to wet methods of extraction with the idea of studying their relative economic value as substitutes for smelting. One of these is W. L. Austin, and he has published some of the results of his investigations in the September, October, and November issues of *Mines and Methods*. He discusses the various processes and analyses the results. In almost every case he finds that the recovery

of the solvent is the weak part, and he points out that as a rule the electrolytic deposition of the copper from the solution does not bring the solvent back to its original form. In this connection, W. A. Greenawalt's invention, described below, should be added to the list of practicable processes. Mr. Austin is most impressed with the Froelich process and considers it worth further experiment and investigation. The solvent is ferric chloride used hot, and the reaction is to form cupric chloride and ferrous chloride. If treating a sulphide of copper sulphur is liberated. The copper is precipitated by metallic iron with the production of ferrous chloride. The ferric chloride is regenerated by agitating the hot ferrous chloride with air. This cycle of reactions is of course not new, and the Froelich invention consists of using hot solutions and of keeping the solutions in all three parts of the pro-

cess the power required by the agitators, and he also discusses the best degree of fineness for the ore.

Electrolytic Treatment of Copper Ore.—In the *Engineering and Mining Journal* for November 26, W. E. Greenawalt describes a process invented by him and now being experimentally tried at Denver, for extracting copper by electrolytic methods direct from the ore. The process has the advantage over ordinary leaching processes in that it will extract gold and silver as well. The solvent is hydrochloric acid, which is formed by treating chlorine, that has been produced by the electrolysis of a chloride such as common salt, with sulphurous acid in the presence of water. The first supply of chlorine is produced by the electrolysis of salt, and subsequently it is regenerated in the reduction of copper from the chloride formed by leaching. The sulphurous acid is obtained by roasting the



cess in violent agitation. By these means the dissolving action of the ferric chloride and its regeneration are greatly hastened. The same physical conditions are employed in the precipitation process, though as Mr. Austin says, the action takes place as readily in a cold solution as hot. The agitation vessels employed are similar to those used in the cyanide process by Paterson and by Hendryx, and consist of tanks with an internal vertical cylindrical chamber up which the solutions are pumped rapidly. The substance wasted in this process is the iron, which is thrown down as ferric oxide during the regeneration of the ferric chloride. One of the troublesome points is that oxychlorides are occasionally formed, and this causes a loss of chlorine. It is stated by Froelich that chalcopryrite should be given a preliminary muffle-roast at a temperature of over 200°C., in order to remove part of the sulphur. As no air is admitted, the sulphur can be recovered, and no sulphurous acid gas is formed. With chalcocite no such heating is required. Mr. Austin's paper contains some information as to

ore or from pyrite. The chemical equations explaining this process are:—

- (1) $2\text{Cl} + \text{SO}_2 + 2\text{H}_2\text{O} = 2\text{HCl} + \text{H}_2\text{SO}_4$
- (2) $2\text{HCl} + \text{CuO} = \text{CuCl}_2 + \text{H}_2\text{O}$
- (3) $\text{H}_2\text{SO}_4 + \text{CuO} = \text{CuSO}_4 + \text{H}_2\text{O}$

The solution employed contains common salt which reacts on the sulphuric acid and sulphate of copper to form hydrochloric acid, cupric chloride, and sulphate of soda. In practice this process can be employed either on oxidized ores or on roasted sulphides; if the latter the sulphurous acid required is to hand, and if the former some supply of sulphide ore must be obtained. As regards applicability of the process to various classes of oxidized ore, it is obvious that those containing much lime or other base metallic compound that is attacked by acid will not prove suitable, and that silicious ores are the most applicable. In carrying out the process in practice, the solution containing salt and free chlorine coming from the vat where the copper has been deposited is taken to another vat where sulphurous acid is introduced, and

the chlorine converted into hydrochloric acid. The regenerated acid solution is passed into the leaching vat containing the oxide or roasted ore. The cupric chloride solution issuing from the leaching vat is treated by an acid stream of sulphurous acid with the formation of cuprous chloride, hydrochloric acid, and sulphuric acid, the object being to produce a copper salt that requires less current for its dissociation in the electrolytic process. The chlorine liberated passes back and the cycle of operations is repeated. The salt and the sulphurous acid are the two substances wasted; they accumulate in the solution as sulphate of soda which appears to have no deleterious effect in any way. As regards precious metals the silver is recovered by the cupric chloride reacting to form silver chloride, while the gold is dissolved by free chlorine, sufficient of which is allowed to remain in the solution. The iron which is present with the ore is dissolved as ferrous chloride, but this reacts on the oxide or carbonate of copper, and the iron is precipitated as ferric oxide. Mr. Greenawalt explains his process in full detail. When reading the paper it will be of interest to refer also to W. Bettel's process described in our issue of February last. The two processes use hydrochloric acid in a solution of brine but the methods of application are widely different. Many other similar processes have been proposed and tried and those invented by Laczkinski and Von Gernet are working on a practical scale.

Buddles for Copper Slime.—In the *Engineering and Mining Journal* for December 3, Claude T. Rice describes the rotating buddles that have been erected at the Ohio Copper company's concentrator at Lark, Utah. We gave a general account of this plant in our issue of February last. The copper ore contains much chalcocite that forms a fine slime. All sorts of slime tables such as the Frue, Isbell, Wilfley, Christensen, and Craven have been tried, but so far none of them effect so good a recovery at so small cost. It is true the recovery is only 20% of the content, but this is pretty fair for the water concentration of slime. No doubt one day concentration by flotation will be tried. There are four buddles, each 20 ft. diam., with a slope of 1 in 10. The wooden deck is covered with expanded metal and a layer of cement is laid upon it. The cement surface is made absolutely smooth and even by means of a travelling emery wheel. It is intended also to try a top dressing of cement such as is used for making imitation marble. The buddles rotate once in $1\frac{1}{2}$ min. and each treats from 12 to 15 tons of dry slime per day.

Base Metals in Western Australia.—We have recently published several articles relating to the gold deposits of Western Australia. The resources of that State as regards other metals form the subject of a lengthy article by A. Gibb Maitland, Government Geologist, published in the November issue of the *Australian Mining and Engineering Review*. The author first discusses tin; he records that it was first discovered in 1888 and that it has since been found in the districts of Kimberley, Pilbara, Thomas River, Gascoyne, Murchison, Coolgardie, and Greenbushes. We may refer our readers to two maps of Western Australia published in our issues of April and December. The metal has been found in gravel and in deposits formed by the disintegration of rocks in situ, and also in granite and in later intrusive pegmatite dikes. The only two places where it has been won commercially is at Greenbushes, in the southwest extremity of the State, and in the Pilbara district. The output of the Greenbushes district up to the end of 1909 was 7318 tons of black tin valued at £510,682.

Most of this was obtained in the gravels of the river beds. The climate is quite different from that of the interior of the continent and there is plenty of water and timber to help mining operations. In addition to the river beds there are many buried gravel deposits or deep leads, and on the successful exploitation of this class of deposits depends the future of the industry. The rocks in the neighbourhood are igneous consisting chiefly of granite; these and the intrusive dikes of pegmatite as already mentioned contain cassiterite, but not in quantities that are likely to yield profits. At a future date some of these lode deposits may possibly be treated as stockworks and mined on an extensive scale. Attempts have been made, but with no great success, to work some of the deposits formed by the disintegration of igneous rocks in situ. These consist of laterite and all sorts of clay and sand; the decomposed products of the rocks have not been washed away, so there is no natural concentration of the cassiterite.

In the Pilbara district lode mining is done at Wodgina and alluvial mining at Moolyella and Cooglegong. The Wodgina deposits are situated about 74 miles from Port Hedland and are near the source of the western branch of the Turner river. The group of hills in which tin is found extends for 20 miles and rises abruptly from the surrounding plain. At the contact of metamorphosed rocks and granite there are many pegmatite veins which appear to have introduced tin into the adjoining rocks. There are indications sufficient to warrant close prospecting. Most of the tin so far produced in the Pilbara district has come from gravel deposits in the tributaries of the Coongan river, centering round Moolyella. At Cooglegong the granite, the metamorphosed sedimentaries, and the pegmatite veins show cassiterite, and the gravels have been worked. Further prospecting is desirable. The total production of black tin in Pilbara up to the end of 1909 was 4461 tons valued at £368,338.

At one time it was hoped that lead would be an important metal in Western Australia, but owing to the known deposits not containing much silver they have not been exploited extensively. The chief supplies have come from the Northampton district on the west coast in the neighbourhood of Geraldton. The ore is found associated with basic dikes which penetrate crystalline schist. There has been little production since 1899. Other galena deposits have been worked in a small way at Uaroo in the Ashburton district.

As regards copper, the first discovery was made in the Northampton district in 1842, and since then copper ore has been found in a great number of places. As none of the deposits carried much gold and as most of them were far from lines of communication, development has not been rapid. The total production to date has been 105,059 tons valued at £688,360. The Mount Malcolm mine at Mount Morgans has been by far the largest producer, being responsible for nearly one-half of the production of the State. In the Phillips River district many discoveries of copper ore have been made, but they are of too low a grade to pay at present. In the West Pilbara district the Whim Well deposit promises to be a most important producer. This mine contains the largest body of oxidized ore yet discovered in the State.

The iron ore deposits have so far only been utilized for the purposes of fluxing in lead and copper smelting. Though it is known that immense bodies of ore exist, no authoritative examination has yet been made, and their commercial value is undetermined. These deposits are found in the Kimberley, Pilbara, Ashbur-

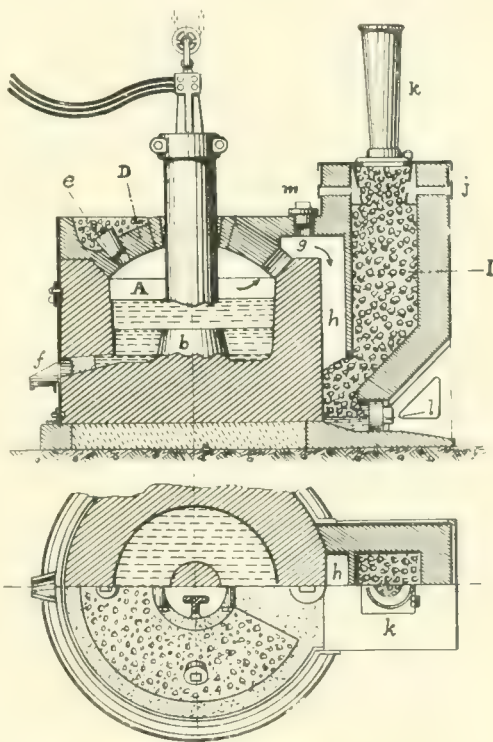
ton, Murchison, North Coolgardie, and Yilgarn districts. In addition to these ores associated with igneous rocks there are many superficial deposits of bog iron-ore, laterite, etc. As regards coal, the only deposits worked are in the Collie River district south of Perth. These are found in the Permo-Carboniferous rocks, and seeing that a similar formation is found in the Kimberley district, there is some hope that coal will be found there also.

Electric Smelting of Zinc Ore.—In a recent bulletin published by the Canadian Department of Mines, Eugene Haanel describes the Côte and Pierron process for smelting complex zinc ores in the electric furnace. It is claimed that by its means zinc and lead can be almost completely separated. The process is based on the fact that iron replaces zinc in sulphide at a relatively low temperature. The charge is made up in such a way that the lead is first removed, and afterwards the iron combines with the sulphur of the blende, the zinc escaping as vapour. The furnace consists of a sheet metal cylinder, the sides and bottom of which are lined with graphite. The top is arched with refractory brick, and has two openings; one is in the centre, for the admission of a cylindrical carbon electrode, and the other (*e*) which can be closed by a plug, is at one side and is used for charging the furnace. The wall of the furnace is extended beyond the lower part of the arch around the feeding hole; the extra surface thus formed is covered with the charge, which, in this way, is dried and pre-heated prior to its admission to the furnace. A slag-hole and spout (*f*) in the side of the furnace permits the discharge of molten slag, and fused metal other than zinc. A conical graphite electrode (*b*) projects above the bottom of the crucible. On the wall of the furnace opposite the slag-hole, and at the eave of the arch, the furnace communicates with the condensing apparatus (*i*) by means of a canal (*g*) and (*h*) formed of refractory material. The condensing apparatus consists of a cylindrical shaft of firebrick filled with pieces of carbon; and it is provided at its base with a door (*l*) through which the spelter is tapped. An orifice (*m*) is made at the top of the furnace for giving access to the canal, in order to clean it when found necessary. The condenser is charged with pieces of carbon by means of a stack (*k*), which is always kept filled. Just below the stack, and at a short distance above the top of the furnace, two openings (*j*) are provided for the admission of atmospheric air, whenever necessary to render the carbon incandescent.

In operating the furnace the charge is placed in the depression around the charging orifice, which is closed. The electrode, inserted through the roof, is lowered into contact with the lower electrode. The current is then passed through the electrode and the heat generated is imparted to the crucible by radiation. The tapping hole (*l*) in the condenser is kept open during the operation. When the crucible has acquired the proper temperature the tapping hole is plugged, and the charge is rapidly pushed through the charging hole, which is then quickly closed again. The charge, heated by contact with the electrode, rapidly increases in temperature until the lead runs out of the tapping hole, which has been opened for the purpose. When the lead reaction has been completed, the tapping door of the condenser and tapping hole of the furnace are closed; the electrode is gradually raised; and the heating of the charge is effected by arc and resistance. The iron now combines with the sulphur of the blende, forming iron sulphide, releasing the zinc in the form of vapour, which passes out of the furnace down the canal into the condenser, imparting its heat to the car-

bon in the condenser. The zinc vapour is liquified in the form of drops which, trickling down, accumulate in the chamber at the bottom of the condenser. To prevent the formation of zinc powder the carbon in the condenser is kept at a red heat. The appearance of white clouds at the top of the condenser stack is evidence of imperfect condensation, requiring immediate regulation of the heat of the condenser.

Iron is, to some extent, volatile; hence, to prevent the spelter from becoming contaminated by the iron, sufficient slag should be provided to protect the molten metals. At the close of the reaction, the slag and sulphide of iron are tapped. The sulphide of iron may be sold as a by-product, or, if suitable, regenerated.



Côte-Pierron Electric Furnace.

It requires 1800 pounds of iron to produce one short ton of zinc. For the production of pure zinc oxide from crude low-grade ore the process is modified. Instead of using iron to absorb the sulphur of the blende, burnt lime and carbon are substituted. The zinc vapour evolved passes into a combustion chamber and is burnt to oxide, which is conveyed by metallic tubes into large storage chambers.

Clancy's Electrochemical Cyanide Process.—In our *Précis of Technology* for November we gave an abstract of an article based on the various patents belonging to J. C. Clancy covering the cyanide process invented by him. Since then a paper has been read by Mr. Clancy before the American Electrochemical Society giving not only a description of the process but a history of its evolution. The process has been adopted by the Moore Filter Co. and will be used in conjunction with their other plant. It is in use at the Portland mine, Cripple Creek, where at first its

reactions were kept secret for the purpose of protecting the process. The paper now published by Mr. Clancy contains the first public discussion of the process.

When Mr. Clancy commenced the study of Cripple Creek ore, his object was to dissociate the tellurium and so obtain a better extraction of the gold by the cyanide process. He found that hypochlorites, hypobromites, and hypoiodites dissolved the tellurium, and he used hypochlorite of sodium (Na Cl O) for the purpose, as being the cheapest. The action was to oxidize the tellurium to tellurous acid, and an excess of caustic soda in the solution combined with it to make a soluble tellurium salt. After this removal of the tellurium he treated the ore with cyanide in the usual way and got a good extraction. Unfortunately the consumption of cyanide was considerable owing to the hypochlorite which remained in the pulp acting as a cyanicide. It was too expensive to have an intermediate washing and two independent sets of treatment. The cost of the hypochlorite was also an adverse item. He next tried ammonium or potassium persulphate and found the same results and the same drawbacks. On trying persulphate and cyanide simultaneously the consumption of persulphate was too high because ferrocyanide was formed and this nullified the action of the persulphate. Subsequently basing his argument on the reactions between hypo-halogen compounds and cyanide he introduced potassium iodide into the solution of persulphate and cyanide, without adding any free alkali. The effect was that the persulphate liberated iodine which then reacted on the cyanide to form cyanogen iodide. Following up this idea he sought for a cheaper oxidizing chemical than persulphate for the purpose of liberating the iodine, and one that would not introduce alkali into the solution. After several trials he used nascent oxygen obtained by an ozonizing apparatus. This had the required effect, but surplus ozone combined with cyanide to form cyanate. To remedy this he added sulphocyanide with satisfactory results. The process worked excellently, but again the cost of the reagent was too great for practical purposes, the first cost of the ozonizing machine being staggering. He therefore turned his attention to the electrolytic production of oxygen in presence of the ore. The difficulty of finding a suitable substance for the electrodes was great and the most satisfactory one was oxide of iron that had been melted in an electric furnace. These electrodes have the advantages that they do not disintegrate under high current density, and are so hard as not to be worn away by the circulating pulp; also the nascent oxygen is not mixed with carbonic acid as is the case with graphite electrodes.

The author then describes at length his experiments on the electrolysis of various cyanides, cyanates, and other compounds containing cyanogen. Of these calcium cyanamide gave under certain circumstances a solution that readily dissolved gold and this substance thus promised to give a cheap source of cyanogen. Combining this discovery with the use of the iodide or other halogen compound, and of the sulphocyanide to prevent the formation of cyanate, he evolved a continuous process capable of treating any ore of gold. In practice he makes a cyanide solution containing calcium cyanamide, sulphocyanide, and iodide, and crushes the ore in it. After the addition of protective alkali, the pulp goes to the electrolysis and agitation vat. The great advantage of the process is that the iodide or other halogen compound and the sulphocyanide are not consumed, and in order to regenerate the solution all that has to be done is to add more

cyanamide. In this way the solution can be used over and over again, and as the process is employed in conjunction with the Moore filter little solution is lost. The average working solution contains 1 lb. cyanide, 2 lb. sulphocyanide, 2 lb. calcium cyanamide, and 1 lb. alkaline iodide, to the ton of water. At a charge of 4d. per kilowatt hour the cost of current is estimated at 14d. per ton of ore treated; and the consumption of cyanide is put at a similar figure.

Mine Records on the Rand. In the *South African Mining Journal* for November 1, John Yates describes the methods of sampling adopted on the Rand, giving the details of practice at Langlaagte Deep, Ferreira, and Simmer & Jack. At Langlaagte Deep, ore is considered developed if there is a drift below it, without regard to the existence or otherwise of winzes; and it need not have a drift above it. The samplers have nothing to do but take the samples; they pass the information obtained to a sampling clerk who works under the survey department, and this department averages the sections, blocks, and stopes, and makes the valuation. There is a stope, assay plan, and a development plan for each reef, and there are three working plans for each reef and one joint plan. The plans are on the horizontal plane. The drifts and rises are sampled after each round and hand-drilled winzes are sampled every week. Hand stopes are sampled monthly at 5 ft. intervals and machine stopes weekly at the machine. Occasionally the latter are sampled at 5 ft. intervals. Each leader is sampled independently. No sample covers a greater width of reef than 12 to 15 in. In sampling very thin reefs a little waste on both walls is included. In calculating the average values the contents of the waste are taken into account and values are calculated to a fixed stopping width. High assays are always included. On the development assay plan the total net reef and its value are indicated and the partings are ignored. Each block on this plan has a record on it of the following items: average net reef, thickness and value; average stopping width; average stopping value; total tonnage on average stopping width.

At the Ferreira the samplers calculate the sections and the monthly averages, and the surveyor estimates the value of the blocks. The sampling is done under the survey department. There is a joint working plan and a joint assay plan for the main reef and the main reef leader, and a working plan and an assay plan for the south reef. There is also a general working plan showing all the reefs but not the values or stopes. The plans are on the horizontal plane. The continuous system of recording the samples has been adopted for the drifts. Drifts, rises, and winzes are sampled 10 ft. apart, and stopes 15 ft. apart, and no samples cover a greater width than 15 in. The values are worked out to a stopping width which varies with the thickness of the reef. Stopes are sampled about once a month. High values having an air of probability are included and in doubtful cases another sample is taken. Each reef and leader is sampled independently. The average thickness and value of the sides of the blocks are recorded. In calculating the average values the content of the waste is ignored.

At the Simmer & Jack ore is considered developed when it has a level above and below. The samplers measure and record the thickness and value of each reef and leader and the survey department completes the calculations. No separate development plan is kept. There is a general working plan which shows the development and the stopping faces, but no values, and a tracing of this plan is used for recording assays. The continuous system of sampling is not used. De-

velopments are sampled every 10 ft. each month. No sample includes a greater width than 12 in. High assays are included. Reefs and leaders are sampled independently and the plans are on the horizontal plane. For the purpose of valuation the stoping width is obtained by including waste when the reef is less than 30 in. In estimating the milling value one-third of the waste in the stoping face is deducted. The gold content of the waste is not included. In sampling the stopes, each leader is sampled and panned (not assayed) separately. To ascertain the average value of the stope, a proportionate part is taken from each sample and the mixture assayed.

Gas Power at High Altitudes.—The *Engineering and Mining Journal* for December 24 contains an article giving the experience of an engineer in connection with fuel supply at the Oplaca Mining company's tin mine at Chocaya, Bolivia. This mine was worked for many years for silver but was closed on the permanent fall of the metal. Three years ago it was reopened as a tin mine and the equipment which came chiefly from England contained a steam-power plant. It was soon found that there was not sufficient fuel available and eventually it was decided to use gas-engines with gas generated from charcoal. This charcoal is made from the churque tree which is grown even at as high an altitude as 10,000 ft. At mines belonging to the Aramayo Francke group in the same district, gas engines operated by producer gas from anthracite have been used for some time, but at Chocaya it was considered that the additional haulage would make the cost of anthracite so much greater as to be prohibitive. A mistake was made by the omission of any note of the altitude when ordering the gas engines, but eventually the engineers got 49 hp. at 14,000 ft. out of an engine rated at 65 hp. This is more than would be expected, so that probably the engine was under-rated. The consumption of charcoal was 1.9 lb. per hp. hour, and the cost of the charcoal was 2s. 9d. per 100 lb. This consumption is higher than that of anthracite at the Aramayo properties.

Filling Stopes at the Simmer & Jack.—In the October issue of the *Journal of the Chemical, Metallurgical, and Mining Society of South Africa*, A. R. Hughes contributed to the discussion on sand filling of stopes by describing the system adopted at the Simmer & Jack. The spot where it is being tried is specially favourable, because it is enclosed, as shown in Fig. 1, by a dike on the east and south, and on the west by a block of ground which is being worked toward the east. From the main drift on the south side of the dike a cross-cut extends north; from this a box-hole rise has been made for 18 ft., entering the bottom of the stope. On the west side of the dike there is an intermediate drift leading through to No. 1 shaft (see Fig. 1). A bulkhead made of 3 by 9 in. deal, supported by 8 by 8 in. upright timbers, was placed across the intermediate drift to the east of the working face, the deals being perforated and covered with cocoa-nut matting on the face next the sand, and forming an outlet for drainage on the west side of the slope. The space is thus enclosed with the exception of the box-hole entering the stope on the south or bottom side. This box-hole is used as the main outlet for drainage. A dry wall was built across it through which a 6 in. pipe projects into the stope. A filter frame 12 in. square covered with cocoa-nut matting and extending up the stope above the level of the sand was placed over the 6 in. pipe, thus forming an efficient filter through which all the drainage must percolate before escaping into the level below (Fig. 2). The square filter is made in 12 ft. 6 in. lengths, one end being made

14 in. square for about 2 ft. to fit over the length previously fixed, so that when the sand rises to about 2 ft. from the top of the filter the next length can be placed over it, and by this means the filter is always kept above the level of the sand (Fig. 3). Inside this frame a covered wooden launder is placed to maintain an opening in case the filter frame collapses. The drainage from the sand is a small stream of about one-third of a ton of clear water, free from cyanide, to every ton of sand deposited. Although about 200 tons of current residue is lowered daily, men are still at work in the stope taking out pillars, etc., and suffer no inconvenience from cyanide or any of its products.

The sand is conveyed from the bottom of the bore-hole in wooden launders 9 in. wide and 7 in. deep with a slope of 15°, on which the pulp flows freely when diluted with a small spray of mine water. The sand forms a compact mass on which men can walk comfortably, in from two to four hours after filling has stopped. The cleaner the sand the better, as slime tends to retard drainage and to form pockets of water

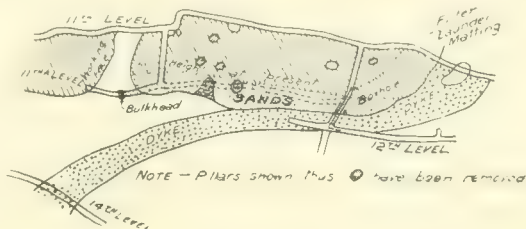


FIG. I.

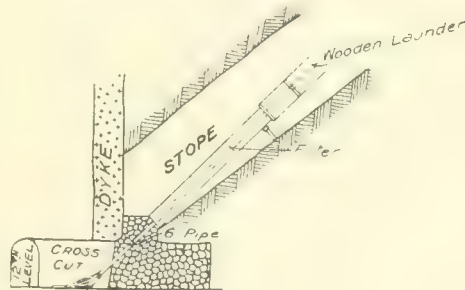


FIG. II.

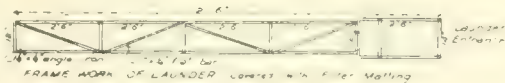


FIG. III.

between the points where the launders deliver the sand.

For a stope less favourably situated for sand filling than that described the author suggests that stulls should be made of stout mine poles hitched at top and bottom, lagged with old pipes and rails and packed with waste rock to a thickness of about 4 ft., the inner face being covered with cocoa-nut matting. This would afford perfect drainage. The sand would exert very little lateral pressure against the stulls, and there would be no uncontrollable mass of sand and slime saturated with water to become a real source of danger in the mine.

CURRENT LITERATURE

Vanadium.—In the December issue of *Metallurgical and Chemical Engineering*, Warren L. Blecker gives a most interesting and comprehensive article on the properties and metallurgy of vanadium. The papers embody the results of much study and investigation on the part of the author and form a valuable addition to the literature on the subject.

Partridge Blast-Furnace.—In *Metallurgical and Chemical Engineering* for December, Clement H. Mace describes his experience with the Partridge hot-blast smelting furnace erected by him in the Alamos district of Sonora, Mexico. We described the principle of this furnace in our issue of April.

Recovery of Tin from Dross.—At the October meeting of the American Electrochemical Society, R. S. Wille described an electric furnace used by the Riverside Metal Refining Co., Connellsville, for recovering tin from tin dross produced in tin-plate manufacture. Over 2 tons per day is recovered in this way.

Electrolytic Production of Calcium.—At the October meeting of the American Electrochemical Society, F. C. Frary, H. R. Bicknell, and C. A. Tronson continued a paper presented a year before to the same society, describing the production of metallic calcium by the electrolysis of the fused chloride.

Smelting Lead-Antimony Ore.—A. H. Hahn, in *Metallurgical and Chemical Engineering* for December, describes smelting practice at Braniff's small smelter near Queretaro, Mexico. The ore is a mixture of sulphides of lead, zinc, and antimony, and contains on an average 40 oz. silver, 8.3% lead, 3.6% antimony, and 3% zinc. In one smelting operation matte and bullion are produced, the latter containing 26% antimony, 70% lead, and 240 oz. silver, and the former 1% lead, 50 oz. silver, and no antimony.

Classifying for Cyanide Treatment.—At the October meeting of the Chemical, Metallurgical, and Mining Society of South Africa, E. H. Johnson read a paper describing the plant erected at the East Rand Proprietary Mines for separating sand and slime before cyaniding. The system adopted is that devised by W. A. Caldecott and described in our issue of November 1907.

Absorbing Sulphurous Gases.—In the *Engineering and Mining Journal* for December 10, G. C. Westby describes his process for preventing the emission of sulphurous acid gas given off by smelters. He passes it through water in which slag dust or slag wool is suspended thus combining it with the bases of the slag.

Tube-Mills.—The *Engineering and Mining Journal* for December 10 describes a multiple tube-mill designed by the J. R. Alsing Co. Instead of one large cylinder, three smaller ones are arranged in parallel and are held together by bands. They are rotated round the longitudinal centre line between the three. By this arrangement the load of ore and pebbles is fairly evenly distributed round the axis of rotation, instead of being always below the axis as in the single cylinder; the effect being to decrease the amount of power required in rotation.

Randfontein Central Plant.—The *South African Mining Journal* for November 26 contains a detailed account of the new metallurgical plant erected at the Randfontein Central mine, in the West Rand. The description was officially supplied by the company on the recent visit of members of the South African Institute of Engineers. There are 600 stamps, each weighing 1650 lb., and 16 tube-mills, 22 ft. long. The capacity of the plant is 5500 tons per 24 hours.

Pyrite Smelting in Leadville.—In the December issue of the *Bulletin* of the American Institute of Mining Engineers, C. H. Doolittle and R. P. Jarvis describe the pyrite smelting process that was developed at the Bi-Metallic smelter, at Leadville, Colorado, during the years 1893 to 1900.

Electrolytic Determination of Lead.—R. C. Benner and W. H. Ross describe, in the *Mining and Scientific Press* for November 12, their modification of the method of estimating lead by electro-deposition as peroxide.

Oil-Shale in the Transvaal.—The *South African Mining Journal* for October 8 and 15 gives detailed information about the oil-shale deposits discovered at Ermelo, quoting J. T. Bagshaw's report, and discussing the geology and economic bearing of these new sources of fuel.

Tin in the Transvaal.—The *South African Mining Journal* for November 5 gives the substance of Hans Marensky's report on the tin deposits at the Zaai-plaats mine in the Waterberg district, Pietersburg, Transvaal. The ore occurs in pipes or shoots, of which there are over 20. No. 13 gives promise of being rich, for large amounts of ore containing 25% have already been blocked out.

Tin in Bolivia.—In the *Engineering and Mining Journal* for November 26, George W. Dean, consulting engineer to the Pan-American Tin Co., describes the conditions of tin mining in Bolivia and gives an outline of the methods employed for concentration.

Chrome Ores.—The *Bulletin* of the Imperial Institute for November contains the first instalment of a comprehensive article on the distribution and utilization of chrome ores.

Filling Stopes.—In the October issue of the *Journal* of the Chemical, Metallurgical, and Mining Society of South Africa, J. D. Marquard contributed to the discussion of Edgar Pam's paper on 'Sand Filling on the Rand' read at the June meeting, by describing the method adopted in the Silesian mines.

Nitrate of Lime.—The *Electrical Review* for December 30 contains a translation of an article appearing in the *Teknisk Ugeblad* describing the hydro-electric plant used for producing nitric acid from the air at Notodden, by the Birkeland-Eyde process. Air is passed through a chamber containing electric arcs and the nitrous gases obtained are afterwards absorbed by water to form nitric acid. This is treated with lime and a commercial nitrate of lime is produced suitable as a fertilizer. All the nitrous fumes cannot be absorbed by water, so the remainder is sent through soda to form nitrate of soda.

Coke in Mexico.—In *Mines and Minerals*, E. B. Wilson describes the coke-oven plants erected at Lampacitos and Las Esperanzas in the State of Coahuila, Northern Mexico. This information supplements that contained in an article by John Birkinbine, an abstract of which was published in our October issue.

New Method of Mining.—In the *Mining and Scientific Press* for November 26, G. E. Wolcott makes a proposition for excavating rock and ore by means of channeling, and breaking down by pneumatic wedges, thus eliminating the use of explosives.

Failure of Debris Barrier.—H. H. Wadsworth, in the *Mining and Scientific Press* for November 12, describes the debris barrier erected across the Yuba river, California, to prevent debris from hydraulic mining from flowing into the Feather and Sacramento rivers. This barrier failed in March 1907 and Mr. Wadsworth, as a civil engineer, discusses the causes at considerable length.

BOOKS REVIEWED

PRACTICAL STAMP-MILLING AND AMALGAMATION.—By H. W. MacFarren. Cloth, small 8vo, 170 pages. San Francisco: *Mining and Scientific Press*; London: *The Mining Magazine*. Price 8s. 6d.

This is a really practical book intended for the man who is in charge of a stamp-mill. The scope and intention is somewhat similar to Adams' Hints on Amalgamation issued by the same firm. The latter book was published fifteen years ago, and since then many improvements have been made in the treatment of gold ores. For instance, table concentration and cyaniding have introduced entirely new factors. Mr. MacFarren's book will therefore be gladly welcomed by those who look for hints on the subject. The author has based this book chiefly on his own experience, and has supplemented his own information by that gained from others engaged in stamp-milling operations. We commend this book to all companies engaged in gold mining; its possession by their staff in the mill will assuredly increase the efficiency and the extraction.

TESTING FOR METALLURGICAL PROCESSES.—By James A. Barr. Cloth, 8vo, 216 pages. Ill. San Francisco: *Mining and Scientific Press*; London: *The Mining Magazine*. Price 8s. 6d.

This book, which is based upon notes used by the author when Instructor at the Michigan College of Mines, refers mainly to laboratory and other comparatively small scale tests for ascertaining the best method of dressing and treating ores on the large scale, both in the wet way and in the furnace. Its thoroughly practical character and the fact that the laboratory tests and plant which are described and illustrated are such as will yield results of practical value as well as of theoretical interest, renders it likely to be of particular service to those, whether students or otherwise, who intend to follow up the tests by experimental work with full-size apparatus. The absolute necessity for doing these small tests before starting on a more pretentious scale cannot be too much emphasized, and is well brought out in the book under review. The processes dealt with include the dressing, amalgamation, chlorination, cyaniding, etc., of gold ores, the dressing, roasting and smelting of typical ores of gold and zinc precipitate, and the determination of the heating value of fuel. Such general matters as pyrometry, the testing of furnace gases and electrolytic processes for refining metals, also receive notice, and the Ziervogel and other wet processes are discussed. To cover so large a ground in about 200 pages necessitates the cutting down of many of the descriptions, so that, in some respects, the work may be regarded as a preliminary to reference to larger treatises each dealing with a special metal or group, although it is by no means an elementary treatise. The latter portion of the work relates to the calculation of furnace charges, etc., and of costs, including data regarding slag composition and methods of determining and describing the nature of the slags. The valuation of ores is covered by a number of schedules which are partly new and partly taken from the ordinary smelters' schedules as issued to buyers. A useful, though short list of works to which the author has referred or which deal with similar subjects, and a good index, add to the value of this work, which may be strongly recommended as dealing with the use of laboratory and small scale tests for deciding upon a method of treatment to be tried on a commercial size testing plant. Even for those who prefer to carry out their

investigations at the office table, this work may be of use by instilling caution into their minds and by causing them to realize the necessity for learning something about the nature and behaviour of the material which has to be dealt with before designing or ordering plant for its treatment. It brings out forcibly the fact that, even though it may be impossible to work out a scheme of treatment from laboratory tests, they often definitely prove that an apparently feasible process cannot possibly succeed and need not receive further consideration.

G. T. H.

MODERN ASSAYING: A Concise Treatise Describing Latest Methods and Appliances.—By J. Reginald Smith, edited by F. W. Braun. Cloth, 8vo, 145 pages, with 80 illustrations. Philadelphia and London: J. B. Lippincott Co. Price 8s. 6d. For sale by *The Mining Magazine*.

As indicated in the preface, this little work deals more with the details of manipulation than with methods of assay, which larger treatises on assaying have already so fully covered. The main purpose which it is intended to fulfil and which it very well carries out, is the description of up-to-date plant for sampling, crushing and grinding and for generally preparing the sample for assay and carrying out the mechanical details of the fire and wet assays. The illustrations are mainly those of such special plant as the author recommends, and illustrate the equipment of a very complete assay office, more particularly in connection with the fire assay. The plant and implements described are typical of modern American practice for obtaining increased efficiency and speed of working.

G. T. H.

THE MINERAL INDUSTRY, VOL. XVIII., for the year 1909.—Edited by Walter Renton Ingalls. Cloth, large 8vo. 890 pages. Ill. New York: McGraw-Hill Book Co. Price 42s. For sale by *The Mining Magazine*.

This year-book fully maintains its established reputation as the most dependable record of mineral and metal production, and of progress in mining and metallurgy. It is just eighteen years ago since the present writer assisted Richard P. Rothwell in the preparation of the first volume, which was then started as the annual statistical supplement of the *Engineering and Mining Journal*, and one of his senior collaborators was Mr. Ingalls, who is now the worthy successor of Mr. Rothwell, as editor of the *Engineering and Mining Journal* and *The Mineral Industry*. Most countries issue official publications dealing with the output of metals and minerals, and the figures contained in them are naturally considered to be the last word on the subject. The official information is often supplied at a date so long after the turn of each year as to be of little interest except for the purposes of record; the figures also are bald and give no explanation of the actual situation. The *Mineral Industry* is the only independent publication giving prompt and live details. In addition it contains an invaluable résumé of the progress in metallurgy. It is a pity that the owners of the book do not afford the editor full facilities for issuing it at an earlier date. We received this volume on December 8, and we cannot help remarking that it is as belated as the Government reports as far as statistics is concerned. Originally the price was 5 dollars and recently it has been increased to 10 dollars or 42s. With the increased price people on this side expected greater promptitude of publication; unfortunately the change has been the other way.

We write this criticism in no carping spirit. So far from doing so we wish to express our continued admiration for the excellent and painstaking work of the

Mr. Ingalls has been defined as a practical mining engineer. It is hardly necessary at this time to give a detailed account of the scope of the work. It contains records relating to all metals and minerals in the United States and other countries. In addition there are in the present volume chapters on the 'Practice of Mining' by H. L. Smyth, 'Progress on Ore Dressing' by R. H. Richards, 'Sampling and Assaying' by F. F. Colcord, and 'Practicable Copper Slags' by E. D. Peters.

Since writing the above review I have been informed that The Mineral Industry will no longer be published by the *Engineering and Mining Journal* and that Mr. Ingalls has resigned the editorship. It will be published in future by the McGraw Hill Book Co. and Albert H. Fay will be editor.

This announcement is in the nature of an obituary notice, for with due deference to the new publisher and new editor, the glory has departed. With Mr. Rothwell it was a labour of love and he was never rewarded by financial profits. Both with The Mineral Industry and the *Engineering and Mining Journal*, professional standing and integrity were the only things he thought about. The proprietors who succeeded him are strictly business men who are not out for glory unless it brings adequate profit. As The Mineral Industry did not pay, they have let it go.

E. W.

SOUTH WALES COAL ANNUAL.—Edited by Joseph Davies and C. P. Hailey. Cloth, 8vo, 400 pages. Ill. Cardiff: The Business Statistics Publishing Co. Price 7s. 6d. For sale by *The Mining Magazine*.

This is a year-book which is of great service to those who are buying high-class coal for steam-raising purposes. It gives full statistics relating to the production of coal, and enumerates the collieries, giving an account of the character of the coal produced by each. The chapters dealing with the system adopted for adjusting the wages of the miners is of value at the present time. The special article this year describes the Fernhill Collieries in the Rhondda valley, coal properties which have been actively developed during recent years.

MINING EXAMINATION QUESTIONS.—Arranged and compiled by G. L. Kerr. Limp cloth, 8vo, 120 pages, with illustrations and folding plates. London: Crosby Lockwood & Son. Price 2s. 6d. For sale by *The Mining Magazine*.

This book has been compiled for the benefit of those who are preparing for the manager's or undermanager's certificate in connection with coal-mining in this country. Mr. Kerr is a well-known author and lecturer on coal-mining subjects. A perusal of this analysis of examination questions submitted to beginners must impress the outsider and the general reader with the fact that the British Government exacts great efficiency on the part of those who aspire to responsible positions in coal-mining.

TECHNICAL DICTIONARY, VOL. IX., MACHINE TOOLS.—Edited by Alfred Schlomann and Wilhelm Wagner. Small 8vo, 700 pages. Ill. London: Constable & Co. Price 9s. For sale by *The Mining Magazine*.

This is one of the series of technical dictionaries issued by the firm of R. Oldenbourg, Munich, Bavaria. It gives equivalent words in German, English, French, Russian, Italian, and Spanish. The present volume relates to machine tools for working metal and wood. The list of contributors and revisers includes the names of many firms of machine-tool makers in Germany, England, and America. As we remarked before, when

reviewing another volume of this series, the book is on a German basis and some of the English words are simply literal translations of the German idiom.

WATER-TURBINE PLANT.—By John Owen Bowring. Cloth, quarto, 200 pages. Ill. London: Raithby, Lawrence & Co. Price 10s. 6d. For sale by *The Mining Magazine*.

The author is well known in connection with the installation of turbine power-stations, and he has had extended experience in Norway and Sweden where water power is so much used. The present book is in a certain sense a catalogue of his specialities, but it contains so much valuable information relating to the theory and practice of turbine engineering that it may be classed as a treatise; as such it deserves a place in the technical library. The printing and illustrations are excellent.

ETHNOGEOGRAPHY OF NORTH AMERICAN GEOLOGY.

By John M. Nickles. Octavo, paper covers, 176 pages. Washington: Government Printing Office.

This is Bulletin 444 of the United States Geological Survey and contains a record of practically every article or paper published during 1909 relating to the geology of North America.

ELECTRIC FURNACES.—By Eugene Haanel. Octavo, paper covers, 80 pages. Ill. Ottawa: Government Printing Bureau.

This is one of the Bulletins of the Canadian Department of Mines and gives an account of recent advances in the construction of electric furnaces for the production of iron, steel, and zinc. In our *Précis of Technology* we give extracts relating to zinc metallurgy.

OFFICIAL YEAR BOOK OF NEW SOUTH WALES.—By John B. Trivett. Octavo, paper boards, 570 pages, with map. Sydney: W. A. Gullick, Government printer.

This is a year book prepared by the Government statistician and deals with the industries of New South Wales, the climate, laws, population, railways, etc. An interesting new feature of the present volume is the chapter chronicling the early history of the State.

TEXT-BOOK OF GEOLOGY.—By Philip Lake and R. H. Rastall. Cloth, octavo, 500 pages. Ill. London: Edward Arnold. Price 16s. For sale by *The Mining Magazine*.

This book is one of Arnold's geological series produced under the supervision of Professor J. E. Marr. It may be divided into two parts, for chapters 1 to 15 relate to physical geology and have been written by Mr. Rastall, and chapters 16 to 30 describe the stratigraphy of the British Isles and have been done by Mr. Lake. The book must be heartily commended, and it is not too much to say that it is a worthy successor to Lyell's *Principles*. Paleontology and petrology are not included in the scope of the book, except the elements necessary for the description of rocks and of characteristic fossils. The type and illustrations are excellent and the photographs add to the fascination of the subject.

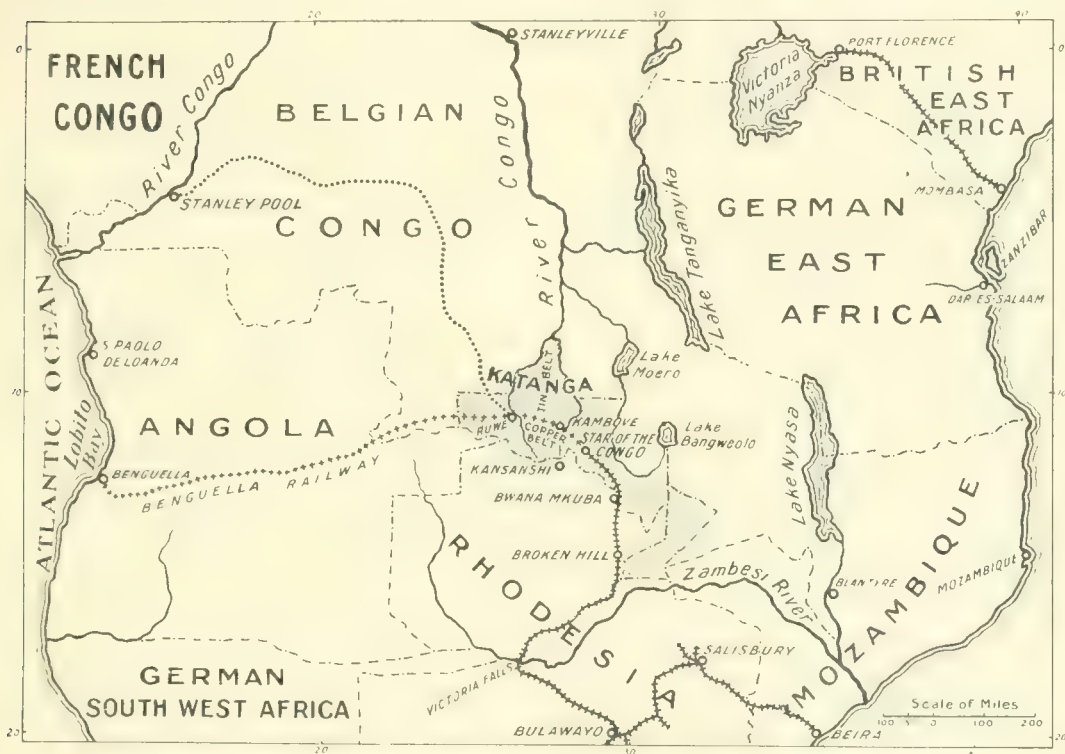
TRANSACTIONS OF THE MEXICAN INSTITUTE OF MINING AND METALLURGY.—Vol. I., 1909-10. Paper covers, octavo, 260 pages, with many maps and illustrations.

This first annual volume of the Mexican Institute contains a goodly show of excellent papers. We have from time to time referred to these as published, but we may enumerate some of them here: R. L. Lloyd on Blast-furnace Practice at High Altitudes, E. Girault on the Cyanide Plant at San Rafael, Pachuca, and M. H. Kuryla on Continuous Agitation.

COMPANY REPORTS

Tanganyika Concessions. - This company was formed in 1899 to acquire exploring rights in the central part of Africa, including tracts in the Belgian Congo and Northern Rhodesia. The chief mining asset is a 45% interest in the Belgian company, the Umon Minière du Haut Katanga, which owns the copper belt in Katanga in Belgian Congo just over the border from Rhodesia. The company also owns shares in the Benguella Railway Co., which is being built to connect the copper mines with Lobito Bay on the west coast, and shares and debentures in the Rhodesia-Katanga Junction Railway & Mineral Co. The last-named company built the railway line from Broken

plant in September, and that the first unit capable of producing 1000 tons of copper per month will be ready to start operations in April. Additional plant with a capacity of 1500 tons of copper per month is now being shipped. Though the European coke costs £10 per ton delivered, it is estimated that the cost of production of copper will be only £32 per ton. When the Benguella railway is finished the coke will be much cheaper. The ore reserves at the Star, Kambove, and other mines are so great that it is estimated that there will be no difficulty in producing sufficient ore regularly to ensure an output of 200,000 tons of copper per year. The exploitation of the properties is postponed until railway communication is improved, and the diamond interests are to be sold to a subsidiary company.



CENTRAL AFRICA, SHOWING THE POSITION OF THE KATANGA COPPER DISTRICT.

Hill to the Star of the Congo copper mine, and it owns the Kansanshi copper mine in Rhodesia. The Belgian Katanga company owns an extensive copper belt, in which are situated the Star of the Congo and the Kambove mines, and also a tin belt to the north. The ore reserves are great, and development has been hindered by their distance from civilization. The energies of the managing director, Robert Williams, have been centred on the provision of railroad communication, and, as it will be seen from the accompanying map, his efforts in this direction have borne substantial results. The orebodies are unusually large and so far contain only oxidized ore, so that much thought and experiment has had to be devoted to their successful beneficiation. The report for the year ended June 30 has just been issued, and the information contained in it was supplemented by Mr. Williams at the subsequent meeting of shareholders. Mr. Williams announced that they began to ship the new smelting

Phoenix Mines.—This company was formed in June 1909 to acquire the tin mines of this name in Cornwall from the Cosmopolitan Proprietary which had been for some time pursuing developments. It belongs to a London group identified chiefly with West Australian business. The capital is £160,000 of which 60,000 shares of £1 each were issued fully paid to the vendors, and 100,000 were issued credited with 10s. paid. The total amount paid up in cash so far on the latter shares is £36,535, leaving £13,465 still to be paid. W. Nance Williams is manager and Nicholas Trestrail consulting engineer. The property is situated 7 miles north of Liskeard and is not far from the Cheesewring, one of the celebrated sights visited by tourists in the West Country. The work at this mine is of a different type from that at some of the other Cornish mines. Large sums of money are being spent on thoroughly testing the lodes and in sinking shafts capable of handling large quantities of ore in a modern manner. The

the Prince of Wales shaft is being sunk to a vertical depth of 1020 ft. in the centre of the property and is expected to meet the main lode at 1,000 ft. on the dip. The report for the year ended June 30 has now been issued and it contains information to December 1. On the latter date the shaft was down 757 ft. It measures 19 ft. by 9 ft. and has been timbered all the way. Pumping and winding plants have been erected. A cross-cut is being driven towards the lode at 720 ft. Holes are being made by the diamond drill to facilitate drainage of the old workings. Two of the old shafts, Seccombe's and Stowe's, have been straightened and timbered to water level, and when the drill-holes are completed and the water removed the rehabilitation of the shafts will be continued. At the present time some ore is being extracted through the adit and treated by the 12 old Cornish stamps. No steps have yet been taken towards building a modern mill, though plans are ready for one capable of treating 7000 tons per month.

Dunderland Iron Ore.—This company was formed in 1902 to acquire iron ore deposits at Dunderland, near the port of Mo, on the Ranen Fiord, west coast of Norway. It was promoted by Sir Joseph Lawrence, and many ironmasters in the North of England and South Wales lent support and subscribed capital. Subsequently the Consolidated Gold Fields of South Africa took an interest. The deposits consist of hematite and magnetite in a gangue that contains apatite. The Edison system of 'giant' crushing rolls and electro-magnetic separators was adopted. The ore was crushed fine and the concentrate was to be made into briquettes. Unfortunately these processes were not tested thoroughly before plant on a large scale was erected. One after another of the various parts of the plant failed to answer, and much additional capital had to be subscribed from time to time. The final collapse came about two years ago when it was found that the principle of dry crushing and concentration was not only an engineering failure but was not favoured by the workmen. The dust was too great for safety, to say nothing of comfort, and as the population of Norway is not so large as to make it necessary for the workers to accept any terms and conditions, the plant was deserted and had to be abandoned. More recently the Ullrich wet magnetic concentrator has been tried and is now being tested on a small scale at the mines, under the advice and supervision of Henry Louis, who has been the technical adviser from the first. The report now issued covers the year ended September 30 and refers to these tests, promising to publish information as to the results when Mr. Louis' report is received. During the year the board has been reconstituted and the secretary has resigned. D. A. Bremner was appointed general manager three years ago when affairs were beginning to be critical, and he still remains at his post. The share capital of the company is £2,000,000, divided equally into ordinary and 6% preference. There are £500,000 first debentures and £30,530 second debentures, £200,000 prior lien bonds, and £81,043 funded interest certificates, all of which have been issued from time to time to keep the company going. The arrears of preference dividend represents a further £375,000.

Cordoba Copper.—This company was formed in August 1908 as a consolidation of the companies operating the Cerro Muriano and North Cerro Muriano copper mines ten miles northeast of the city of Cordoba, Spain. William Frecheville is chairman, and John Taylor & Sons are the managers. W. H. Rundall, the superintendent, has been recently succeeded

by James Hocking. The ore deposit has been difficult to follow and work, and the concentration and smelting problems have given trouble. In the report for the year ended September 30 the directors speak more cheerfully and show that in many ways the company is now in a more favourable position. During the year the developments have disclosed promising bodies of ore at depth and the reserves have been increased, now standing at 132,903 tons averaging 3.28% copper, an advance of 10,508 tons in quantity and $\frac{1}{4}$ % in value. During the year 62,299 tons of ore was raised, and sent to the picking floors. Of this 19,943 tons was sent to the old jigs and buddles; 11,790 tons was treated in the new wet concentration plant; and 11,198 tons went to the magnetic separator. Some of the sorted ore was sent direct to the smelter, and the rich fine screening direct to the sintering furnace. The old jigs and buddles and the magnetic separator have recently been abandoned and the whole of the output will in future go to the new mill. The Murex magnetic process has been installed for the treatment of 50 tons per day of middling and tailing from the jigs and it promises to give satisfactory results. Sintering by pot-roasting was adopted two or three years ago for the preparation of the concentrate for smelting. Hitherto the metallurgical processes have ended with the production of matte, but it is now intended to erect a converting plant. As regards the financial results of the year, the income from the sale of matte, etc., was £76,259 and the cost was £70,102. Further items were: £4800 written off for exploration and shaft-sinking; £889 written off preliminary expenses account; and £5000 carried to reserve. In accordance with the financial scheme on the formation of the company, 100,000 new shares of 5s. each have been subscribed, bringing the issued capital to £164,860, divided into 659,440 shares of 5s. each. During the year £17,071 has been spent on capital account on new plant and shaft-sinking.

Frontino & Bolivia.—This company was formed in 1864 to work the Silencio and other gold mines in Colombia, South America. The results were good for a long period of years, but from 1901 onwards a variety of causes placed the company in an unsatisfactory position. The costs were high, and it was decided to electrify the plant with a view of making operations cheaper. Unfortunately, however, the water supply used for generating current was found to be unreliable. The directors, considering that the mine had arrived at a period when altered conditions made further advice necessary, commissioned Pellew Harvey & Fell to examine and report, and a year ago George P. Chaplin was appointed manager. The present report covers the six months ended June 30 and it shows that affairs are beginning to improve. The ore sent to the mill was 13,140 tons from which gold to the value of £60,440 was recovered by amalgamation and cyanide. This was an increase of £19,675 as compared with the previous half-year. At the same time the expenses advanced £8202. The working profit was £10,137 as compared with a loss of £1303. Out of the profit, debenture interest £2256 was paid; and the remainder used to partly extinguish the adverse balance brought forward from the previous half-year. Mr. Chaplin reports that an increased amount of development work has been done and with good results, but he fore-shadows the expenditure of further money in order that development may be brought well ahead of the mill. He also mentions that he has commenced an overhaul of the surface plant and hopes to be in a position to raise more ore and at a less cost before long. Mr. Chaplin has since resigned.

New Chuquitambo Gold Mines.—This company was formed in 1901 for the purpose of acquiring gold mines at La Quinua, in the district of Cerro de Pasco, Peru. In 1907 it became necessary to reconstruct and the capital was reduced in the proportion of 16 to 1. The capital now stands at £35,000. A 40 stamp mill was erected and started work in August 1907. Merricks, Crane & Co. are the consulting engineers, and Joaquin Bonany is manager. The present report covers the year ended June 30. During this time 22,960 tons was crushed yielding gold worth £8837. As the expenses were small it was possible to pay a 5% dividend on the reduced capital, bringing the dividends since the reconstruction to 28%. The report states that the new Santiago adit has been driven 700 ft. and that the remaining distance 600 ft. should be finished by March. It is then hoped that the orebody will be found and that it will retrieve the fortunes of the company.

Corocoro United Copper Mines.—This company was formed in England in August 1909 to consolidate copper properties at Corocoro in Bolivia belonging to J. K. Child & Co., Carreras Brothers, Compania Sud Americana de Cobre de Corocoro, and Noel Berthin's heirs. The control is in France, Baron Rene de Batz is chairman, and Isidore Brun is general manager. The first annual report covers the 11 months ended June 30. During this time the output at the mine was 57,947 tons of ore averaging 2.35% copper, and from this 1790 tons of concentrate containing 76% copper was produced. This output is only small, but work was practically suspended with a view to reorganizing the business of the various companies coming into the consolidation. The mining and metallurgical plant also required a general overhaul. Nevertheless a trading profit of £13,240 was made, and after deduction of administration expenses, a net profit of £8382 was carried to the balance sheet. As regards cost, based on the production of 76% concentrate, it is figured that the cost per ton of copper at Corocoro is £38. Another £5 is spent on railway freight to Mollendo and another £4 for transport by sea. A new main shaft is to be sunk and used instead of the numerous small shafts of the individual properties, and an aerial ropeway is being built. A great convenience will be gained by the completion of the new railway line from Arica to La Paz. It is now being built from both ends and should be finished next summer. The issued capital is £636,107.

Uruguay Goldfields.—This company was formed in June 1909 to acquire the Zapucay and Independencia gold mining properties in the Rivera department, Uruguay. W. H. Argall is the consulting engineer and Frank Holmes is manager. The report now issued covers the 14 months from the date of registration to September 30. The Zapucay property contains two lodes named Tupambai and Oriental. The former has been traced 1500 ft. on the surface and the

latter for 1000 ft. There are indications that these two lodes join at the eastern end and a shaft is being sunk at the expected point of junction. No indication of the content is given in the report. A 10-stamp mill is in course of erection. As regards the Independencia group the exploration and development work has disclosed wide veins. No information as to the value of the ore is published. The issued capital of the company is £79,000 of which £60,000 was purchase price in shares.

Uruguay Consolidated Gold Mines.—This com-



Bolivia, Showing position of Corocoro.

pany was formed in August 1909 to acquire the San Gregorio gold mine at Corrales in the State of Rivera, Uruguay, from a French company. The directorate is the same as that of the Uruguay Goldfields, and Frank Holmes is manager. The capital is £127,307 in shares, and there are £15,000 debentures. W. H. Argall, one of the directors, has visited the mine, and reports that 200,000 tons of ore are available above the 200 ft. level, averaging 18s. per ton, and that the cost should not be more than 8s. per ton. This reserve is in addition to the many hundreds of thousands of tons in the surface workings, the content of which he does not specify. The 60-stamp mill erected by the former owners commenced work in August on ore containing gold worth 13s. 4d. per ton and treated 4000 tons in two months. The ore is low grade and

more working capital is required as well. It is therefore proposed to offer the remaining 22,093 shares. It may be mentioned that the Hampton Uruguay Co. subscribed for 25,000 £1 shares to provide working capital out of the 32,300 shares issued for this purpose. The mine was started in 1894 by the old Hampton Plains Estates Co. which was originally formed in 1894 to operate in Western Australia, but never made any profit.

Copiapo.—The report of this company operating the Dulcinea mine in Chile covers the year ended June 30. It shows that the position of affairs has not improved. A year ago we gave a history of the company and showed that it dates from 1836. A few years ago when profits were diminishing to vanishing point the control changed hands and passed to the Siemens group. The present report shows that 12,752 tons of ore was smelted yielding 1582 tons of matte containing 775 tons copper, 500 oz. gold, and 12,036 oz. silver. The receipts from the sale of the matte were £40,928, and other items brought the total income to £52,113. The expenditure including depreciation and debenture interest was £68,708, leaving a loss of £16,595. The overdraft at the bankers now stands at £46,000. The ore reserve on June 30 was 56,425 tons averaging 7%. With the present shortness of working capital development work is greatly hampered.

West Canadian Deep Leads.—This company was formed in February 1908, to acquire the Moxley deep lead property in Little Valley, Cariboo, British Columbia. In 1909 the Allison lease was acquired. L. A. Bonner is manager, and Professor S. H. Cox is consulting engineer. The issued capital is £137,030. Owing to many initial difficulties in connection with pumping, the meeting of shareholders has been postponed from time to time, and the first annual report was only issued last month, covering the 2½ years from the formation of the company up to September 30 last. Mr. Bonner's report of progress gives a clear account of the objects and methods. The idea is to sink a shaft to what is considered the main lead of the Cariboo gold belt, the position of which has been determined by boring operations. This shaft goes through sedimentary deposits which contain much water. Its dimensions are 6 by 18 ft., and contains two winding compartments and a large pumping compartment. An adit was driven to meet the shaft at 40 ft. depth with the object of facilitating the drainage of the water from the upper gravel. Borings had shown what appeared to be a cemented gravel at 60 ft. depth, and it was hoped that this layer would be impervious and stop the surface water from penetrating into the lower workings. This hope proved illusory, for the water found many loose places in the layer. Additional pumps had therefore to be provided. It was subsequently found that surface streams were being drained by these pumps, so dams and flumes were built to divert them. The shaft is now down 121 ft., and is in dry ground. Before the lead is found it is expected, judging by the results of boreholes, that it will be necessary to go through other wet strata. In order to reduce pumping expenses, it was decided to erect Cornish pumps driven by a Corliss steam engine instead of continuing to use the sinking pumps.

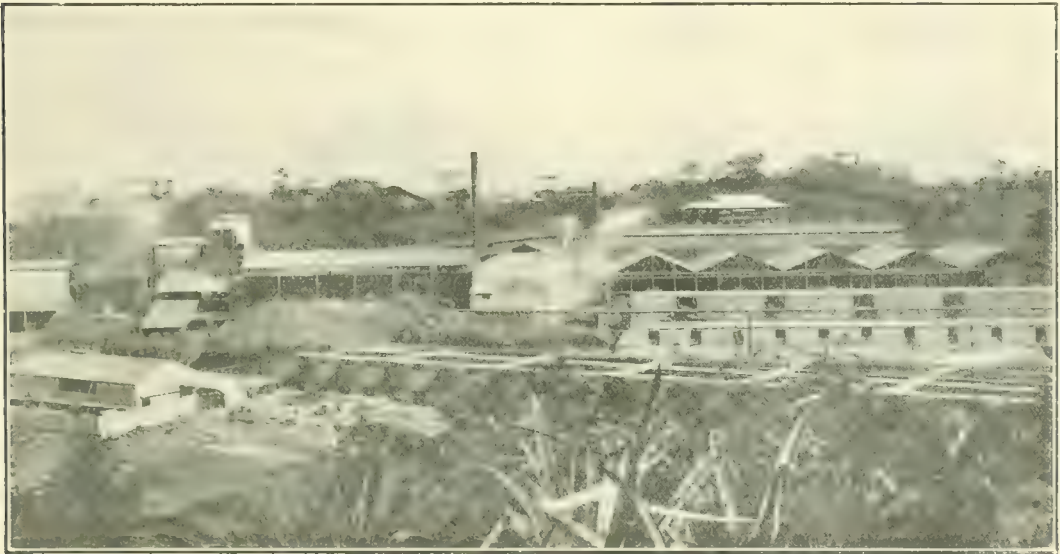
Stratton's Independence.—This company owning the Independence mine in Colorado was reorganized in 1908 with reduced capital for the purpose of 'cleaning-up' this once great gold producer. The mine it-

self is let to tributors, and the company is working the old dumps by means of plant erected for the purpose by Philip Argall. The report for the year ended June 30 shows that the tributors raised 24,480 tons of ore which was sold to smelters, the net income received being £84,370. Of this £47,216 was paid to the tributors and £37,154 was the company's share. During the same period 68,711 tons of dump material was treated, yielding 1964 tons of concentrate worth £17,470, and 3372 oz. of bullion realizing £13,460. The profit from this source was £5459. After the expenses of development, maintenance, and administration had been paid, the net profit for the year was £18,107, which, together with £7844 brought forward, left an available balance of £25,950. The dividends paid absorbed £25,000. The engineers' reports show that the main levels in the caved area have been reopened and exploration work is being actively prosecuted by both the tributors and the company. One of the methods of treatment of medium grade ore devised by Mr. Argall has not been continued, owing to lack of the particular sort of ore for which the process was intended. This consisted of dry coarse crushing, the object being to catch the friable fine containing the richer telluride, and to discard the harder and larger pieces which contain little of value. Mr. Argall has since utilized this plant for the purpose of increasing the work done on the dump material by the water concentration plant. The mine and dump are likely to bring profits to the company for several years. We would draw attention to Mr. Argall's account of the development of the cyanide process in Cripple Creek, appearing in our Denver letter.

Champion Reef.—This company belongs to the group of gold mines in the Kolar district of India managed by John Taylor & Sons and the mine is situated immediately to the north of the Mysore. As recorded in our notice a year ago the production and profits were maintained at a high level for many years, but three years ago the content began to fall and is now less than half of what it used to be. The dividends have accordingly greatly suffered. The report for the year ended September 30 shows that developments have disclosed ore of rather better quality and have also added to the available reserve. During the year no less than 19,265 ft. of development work was done, an increase of 5117 ft. on the previous year. On September 30 the reserve was estimated at 322,513 tons averaging about 9 dwt. This is sufficient to keep the mill employed for nearly two years. At a great many points the orebodies give evidence of persistence, and in order to afford facilities for developing and working them at depth, a second vertical shaft is being sunk in the centre of the property. There are at present three shafts on the dip of the lode, Carmichael's, Glen, and Garland's, and there is also a vertical shaft, Tennant's. The new shaft will be circular and brick-lined. It is now down 2500 ft. and a cross-cut has been started to cut it at 3000 ft. During the year under review 186,680 tons was raised and sent to the battery, where 88,039 oz. of gold bullion was recovered; and 252,779 tons of tailing yielded by cyanide 27,725 oz. The total recovery was 115,764 oz. containing 104,281 fine oz. which sold for £441,255. The working cost has been lowered during the year, by reason of various economies, and also on account of the lower price paid for electric power obtained from the Cauvery Falls company. The costs per ton were 31s. 6d. or 3s. 3d. lower than the previous year. The amount of dividend distributed was £60,666 or 23½% on the capital of the company. The company is in a strong financial position, having over £100,000 cash reserve.

Hutti (Nizam's) Gold Mines.—This company was formed in 1901 to acquire gold mining rights in the state of Hyderabad, India, from the Hyderabad Deccan Co. Shortly afterward one of the properties, the Topuldodi, was floated as a subsidiary enterprise, but was re-purchased in 1908. Dividends have been paid regularly since 1903. The capital is £70,000, having been increased from £50,000 when the Topuldodi was re-absorbed. F. W. Grey and Thomas Morgans are on the board and J. Douglas Hay is manager. The report for the year ended September 30 shows that 38,706 tons of ore was treated, producing gold worth £42,964 by amalgamation, £16,491 by cyanide, and £1083 from slag, etc., a total of £60,540. The royalty paid to the Nizam's government was £3018, and a profit of £9236 was made. A dividend at the rate of 5% absorbed £3480. The cost of working was increased during the year by extra development work, and much of it was in poor ground. Toward the end

90,860 tons of ore was sent to the mill, and 72,115 oz. gold and 4339 oz. silver recovered, the total value being £306,322. This was the largest production yet recorded. The working profit was £175,716, and, after paying government royalty and debenture interest, and allowing for depreciation and development, the net profit was £118,878, as compared with £44,792 the year before. The amount brought forward from the previous year was £49,544, so the available balance was £168,423. Out of this £149,580 has been distributed as dividend, being at the rate of 75%. During the year the outstanding debentures have been discharged. As regards ore reserves, the content of gold is estimated at £1,910,000, as compared with £2,000,000 a year ago. Owing to floods, and also because attention has been centred on the building of the new metallurgical plant, less development work has been done than would otherwise have been the case. Generally speaking, the development at Justice's mine have



THE NEW METALLURGICAL PLANT OF THE ASHANTI GOLDFIELDS.

of the year, however, a drift on the 1740 ft. level came into ore, and for 160 ft. the vein was 3 ft. thick and assayed 1 oz. per ton. The prospects were thereby greatly improved, and consequently the sinking of the shaft was continued with a view of commencing another level at 1840 ft. In order to develop this part of the mine efficiently it is probable that a new shaft will have to be sunk and the board will have to consider the ways and means for providing the necessary funds. As regards ore reserves, Mr. Hay reports that the amount immediately available for extraction is about 40,000 tons, a figure approximately the same as a year ago.

Ashanti Goldfields.—In our issue of January 1910 we gave a lengthy abstract of the report of the Ashanti Goldfields for the year ended June 30, 1909, and quoted W. R. Feldtmann's account of the discoveries of rich ore in the Obuasi workings, and of the new plant then in course of erection. The report of the directors for the succeeding year ended June 30, and one by Mr. Feldtmann bringing technical details down to September 30, have now been issued. During the year

not been so favourable, but this has been more than compensated by the discoveries in the lower levels of the Ashanti mine. An illustration of the new plant is given herewith. Mr. Feldtmann reports that the fourth or last unit is now practically complete and that, commencing with 1911, the yield of gold should be £40,000 per month.

Kalgurli Gold Mines.—This company owns a property at Kalgurli to the north of the Associated Gold Mines. Production commenced in 1897 and dividends were first paid in 1902. The largest profit was made in the year 1906-7 when £210,000 was distributed. The report now issued covers the year ended July 31. During this time 127,600 tons was treated and gold to the value of £332,522 recovered. These figures compared with 128,220 tons and £346,386 respectively during the previous year. The extraction was 52s. 1d. per ton and the working cost 20s. 1d. per ton. After the payment of taxes and administration, and spending £21,389 on development, the profit was £134,604. Adding £40,960 brought forward from last year the distributable profit was £175,564, out of which £150,000

the ore is being treated at the plant, and the recovery was 70% of the lead and 80% of the zinc. Further additions are being made to the plant and the extraction should be gradually increased. Development work has not yet been resumed, but plans are ready for exploratory work in the lower levels of Thompson's shaft. In order to provide additional capital for developments and for additions to the concentrating plant, £30,000 debentures carrying 6% interest are to be issued.

Hampden Cloncurry.—This company was formed in Melbourne in 1906 for the purpose of developing the Hampden and Duchess copper properties near Cloncurry, North Queensland. It was reconstructed in July 1909. Such well-known names as Knox, Schlapp, and Baillieu are found on the list of directors. The report now published covers the six months ended August 31 and describes the progress of development, of smelter facilities, and of the railway connecting with Cloncurry. Erle Huntley, the manager, reports that at the two mines there are reserves of 215,100 tons averaging 9½% copper. It is estimated that on smelting, each ton of copper will contain 1 oz. gold. In order to provide funds for completing the surface equipment, the smelter, and the railway, £100,000 in 6½% debentures is being subscribed, a large part by E. L. and C. Baillieu.

Sulphide Corporation.—This company owns the Central mine at Broken Hill. Gibbs, Bright & Co. are the controllers, and C. F. Courtney is manager. It was floated in 1895 by Gibbs, Bright & Co. and the Exploration Company conjointly, and in addition to the mine the Ashcroft wet electrolytic process was purchased. Subsequently this method of treating the ore was abandoned and at about the same time the Exploration Company withdrew. The ore is now treated for lead by jigs and tables, and the zinc tailing is treated by the Minerals Separation process. For a long time the ordinary shares received no dividend, but payment was resumed during the year July 1908-9 when 10% was distributed. The preference shares have received 10% per annum to date. The report for the year ended June 30 shows that the company is now highly prosperous and the preference shares (£550,000) and the ordinary shares (£412,500) both receive dividends of 15%. Production at the mine has continued without interruption during the year and 231,748 tons was raised. The lower levels have yielded additional reserves which now stand at 2,702,000 tons. The ore raised yielded 51,342 tons of lead concentrate assaying 61·8% lead, 9·4% zinc, and 28·4 oz. silver. The tailing and slime, together with 47,129 tons of dump tailing, were treated in the zinc plant and yielded 88,767 tons of zinc concentrate assaying 43½% zinc, 11·2% lead, and 14 oz. silver. Plant is now being erected for the purpose of re-treating this concentrate in order to remove some lead and increase the zinc content. The lead concentrate is smelted at the company's works at Cockle Creek, where a new smelter is in course of erection. Most of the zinc concentrate goes to Germany and some to the Central Zinc Co.'s works at Seaton Carew in the North of England. It is notable that by the present arrangement of the concentration plant, the whole of the ore is beneficiated, the slime going to the flotation plant along with the zinc tailing, as outlined in our article published in November.

British Broken Hill.—In our issue for June last we recorded that this company owning Blocks 15 and 16 on the Barrier Range, situated between the properties of the Block 14 Co. and the North Broken Hill Co., had not been so successful as others in the district on account of lower contents, and that during periods of depression in metal prices work had to be suspended. We recorded that operations had been at a standstill since December 1907, but that the lead concentration plant was being rebuilt and an Elmore plant provided for the treatment of the zinc tailing. The report for the half-year ended June 30 has now been issued, and it contains supplementary information down to December 10. The new plant was started on June 15, and its capacity has gradually been increased, until during the 28 days ended December 10, 10,295 tons of ore was treated, yielding 1503 tons of lead concentrate, containing 954 tons lead, and 37,575 oz. silver; also 1738 tons of zinc concentrate containing 739 tons zinc,

191 tons lead, and 18,266 oz. silver. The recovery was 70% of the lead and 80% of the zinc. Further additions are being made to the plant and the extraction should be gradually increased. Development work has not yet been resumed, but plans are ready for exploratory work in the lower levels of Thompson's shaft. In order to provide additional capital for developments and for additions to the concentrating plant, £30,000 debentures carrying 6% interest are to be issued.

Hampden Cloncurry.—This company was formed in Melbourne in 1906 for the purpose of developing the Hampden and Duchess copper properties near Cloncurry, North Queensland. It was reconstructed in July 1909. Such well-known names as Knox, Schlapp, and Baillieu are found on the list of directors. The report now published covers the six months ended August 31 and describes the progress of development, of smelter facilities, and of the railway connecting with Cloncurry. Erle Huntley, the manager, reports that at the two mines there are reserves of 215,100 tons averaging 9½% copper. It is estimated that on smelting, each ton of copper will contain 1 oz. gold. In order to provide funds for completing the surface equipment, the smelter, and the railway, £100,000 in 6½% debentures is being subscribed, a large part by E. L. and C. Baillieu.

Phillips River Gold & Copper.—This company was formed in 1906 to acquire copper deposits in the Phillips River mining division in the southern part of West Australia. Part of the property was sold shortly after to a subsidiary company called the Mount Cattlin Copper Mining Co., but has since been repurchased. The share capital is £200,000, and £100,000 debentures were subscribed at the beginning of 1910. A railway was built to connect the mines with Hopetoun, and a smelter and concentrating plant was built. The orebodies have proved disappointing so far. The report for the year ended June 30 shows that development is centred on the Desmond-Elverton group of lodes, and that 2031 ft. of work was done. At several points promising ore was found. Some development has also been done at the Mount Cattlin mine. At the Ironstone property prospecting has been done by diamond-drilling. The Benson and Martin mines have been let on lease and a few hundred tons of ore have been raised by the tributors. The profitable oxide ores are exhausted and the smelter which started in July 1909 is treating chalcopryrite from the Elverton and Cattlin mines and cupriferous pyrrhotite from the latter, together with such ore as is raised by the tributors at the other mines. Pyrite smelting was tried, but it was found that the gangue matter required more heat than could be supplied by the sulphur. The plan now is to pick out the richer parts, concentrate the remainder, and sinter the concentrate. In this way the refractory gangue is largely removed, and a smelting charge is obtained which contains sufficient sulphur to reduce the amount of coke to a minimum. In addition to the blast furnace, a converter plant has been erected. During the year under review, 1332 tons of blister copper was produced containing 1318 tons copper, 5435 oz. gold, and 9982 oz. silver. The income from the sales was £62,466, and the loss on the year's work was £55,421, of which £22,205 was depreciation. The expenses in connection with the starting of smelting and concentration made the costs higher than they will be in future. The company has an excellent plant, and a satisfactory method of treatment has been settled. The future will depend on the development of the ore deposits; the report gives no indication of the reserves.

Gopeng Tin.—This is one of the tin mining companies organized in Cornwall for the purpose of working tin gravel in the Malay States. The accompanying map shows the town of Gopeng in the district of Kinta in the State of Perak. The company was organized in 1892 and reconstructed in 1901. The issued capital is 71,200 shares of £1 each. The company has been most successful and the profits have been sufficient to repay the capital many times over. The report for the year ended July 31 shows that six months have been at work continuously. One of them

managers, Osborne & Chappel, report that the prospects for the future are excellent. The low cost of operation and of administration is specially notable. The directors' fees, secretary's remuneration, auditors' fees, office rent and expenditure, postage, and cables only totalled £490, and the manager's fees were included in the local expenses. The list of directors contains such names as Wickett, Bain, Lanyon, and Pearce, all long and honourably connected with Cornish mining and metallurgy.

Pahang Consolidated.—This company was formed



THE TIN DISTRICTS OF THE MALAY STATES

has been used as a hydraulic elevator since March and the treatment of the low-lying ground has been greatly improved thereby. The output of tin concentrate at Gopeng during the year was 383 tons, which sold for £32,953. The cost of working was only £6976. At the subsidiary Ulu Gopeng property 93 tons of concentrate sold for £8027 and the cost was £4826. After paying office expenses and income tax, the profit available for distribution was £28,733, which is the largest figure yet recorded. Out of this £24,920 has been distributed as dividend being at the rate of 35%. The

in 1906 for the purpose of consolidating the business of the Pahang Corporation with that of other adjoining tin-mining companies, all situated on the eastern side of the Malay Peninsula. The management is in the hands of the Borneo Company. Two years ago it was found that the ore reserve had been greatly overestimated and that energetic development was pressing needed. As so many of the tin properties in the East are alluvial, it ought to be mentioned that these are vein mines, and that the tin is accompanied by many other minerals such as pyrite, arsenopyrite,

an independent examination. His recommendations coincided with those of Mr. Pawle, so £250,000 new capital was created and £125,000 subscribed. At the same time the Borneo Company, which had advanced £39,000 as working capital, accepted debentures to secure the debt. The present report covers the year ended July 31. Mr. Pawle reports that 80,736 tons of ore was mined and milled, producing 908½ tons of tin concentrate; in addition the alluvial mines let on tribute produced 54½ tons. The receipts derived from the sale of the 963 tons were £90,376 and the expenses at the mine were £87,425. London expenses, debenture interest, etc., extinguished the balance of profit, and the net result of the year's operations was a loss of £7296. Of the expenses, development naturally accounted for a large part, the sum being £20,208; the distance driven was 12,527 ft. Unfortunately this work has not resulted in any important discovery. Mr. Pawle gives some interesting information relating to experiments with an Elmore flotation plant which was erected for the purpose of obviating the necessity for roasting. Unfortunately the quality of oil used was unsuited for the purpose and in spite of many variations it is not possible to effect so complete a separation as to make the roasting operation unnecessary. Other oils are now being tried with the hope that the action of the flotation process will be improved.

Wankie Colliery.—This company was formed in August 1909, as a reconstruction of the Wankie (Rhodesia) Coal, Railway, and Exploration Co. The capital is £205,000 in 10s. shares, and there are £60,000 debentures. The coal mine is on the main line of the Rhodesian railways and is situated 203 miles north-west of Bulawayo. The company is under the control of the British South Africa Co. and the Mashonaland Agency, and A. R. Thomson is manager. The report for the year ended August 31 shows that 194,760 tons of coal was raised, and 140,558 tons sold, which brought £89,222. The profit for the year was £28,967, out of which a dividend of 10% has been distributed. The coal is of variable quality and during the year 20% was rejected as unsaleable. The deposit varies also in thickness. Fireclay of serviceable quality has been found and some of it is mined. The engineer reports that the mine is developed well ahead, and that the pumping and screening plants are kept in excellent condition.

Giant Mines.—This company was formed in 1903 to acquire from the Enterprise Gold Mining & Estates Co. the Giant gold mining property situated 65 miles west of Salisbury, Rhodesia. The mine belongs to the Weil group and the consulting engineers are the Consolidated Gold Fields of South Africa. Milling commenced at the end of 1905. The present report covers the year ended June 30. The amount of ore treated was 65,953 tons and the production of gold was 24,089 oz. worth £102,067, or 30s. 11d. per ton. The cost at the mine was £57,750, and debenture interest, taxes, and cost of administration in London accounted for £9420, leaving a profit of £35,290. The dividend absorbed £36,688, being at the rate of 15%. The ore reserve has been substantially increased during the year, and amounted to 307,821 tons averaging 9.1 dwt., as compared with 204,846 tons averaging 10.4 dwt. the year before. The directors have written

off £10,000 from the reserve account against the loss of the old main shaft which collapsed. The new plant was ready for work in February, but owing to scarcity of labour in the mine and mill, it has not been possible to get the full benefit and to treat 12,000 tons per month as designed. The shortness of labour has also made it necessary to curtail development work.

Glynn's Lydenburg.—This company was formed in 1895 to acquire a gold mining property on the Sabie river in the Lydenburg district of the Transvaal. Milling commenced with 10 stamps in 1897 and dividends have been paid from the beginning. The control is with the Wernher-Beit-Eckstein group, and G. C. Damant is manager. The report for the year ended July 31 shows that 32,155 tons of ore was mined and milled, yielding 7567 oz. by amalgamation in the battery and tube-mill plates, and 13,331 oz. by the cyanidation of sand and slime. The value of the total production was £87,060 or 54s. 1d. per ton milled, and the working cost was £30,068 or 18s. 8d. per ton. In addition £12,607 was spent on development, and £4709 on administration, while £5116 was paid as tax, and £42,500 distributed as dividend, being at the rate of 25%. During the year 8861 ft. of development work was done, and 43,619 tons of ore added to the reserve, which stood at 82,870 tons on July 31. The metallurgical plant was extended by the provision of a tube-mill in April. Mr. Damant reports that trouble is experienced in obtaining labour, as there is so much other work in the neighbourhood, such as railway construction, that offers more congenial and better paid occupation.

Oroya Black Range.—This company was formed in 1906 to acquire the Sandstone leases in the Black Range district, East Murchison, West Australia. Bewick, Moreing & Co. are the managers, William Pollard is superintendent, and H. C. Hoover and J. H. Corder James are on the board. The company is an offshoot of the Oroya Brownhill, of Kalgoorlie, and was formed when the latter was showing signs of nearing the end. The capital is £199,890, and dividends commencing in 1908 have totalled to date 32½%. The report for the year ended August 31 shows that the results obtained on the 3rd, 4th, and 5th levels are not so good as was expected, and the ore developed has not quite kept pace with the capacity of the mill. It is estimated that the reserve is sufficient for 17 months. There are some parts of the mine where developments are hopeful. During the year, 54,180 tons were raised and treated, yielding by amalgamation and cyanide 27,806 oz. valued at £118,072. The expenditure at the mine, including £13,495 for development, was £83,185 and after allowing for depreciation and paying London expenses and taxes, a profit was left of £24,516. The dividends for the year were 12½% and absorbed £24,986. As an off-set against the disappointing results at Black Range, the company has recently acquired a useful asset in the form of 50% interest in the Youanme property, which is situated 60 miles to the southwest. The other half interest has been acquired by the Oroya Exploration Co. On this property veins have been traced for 3000 ft. along the outcrop; there are two lodes which, in the opinion of the engineers, may prove to be branches of the same. A shaft has been sunk near the centre of the property and drifts commenced at 44 ft., 80 ft., and 170 ft. At the 80 ft. level, 1020 ft. is in ore, having an average width of 5 ft. 6 in. and a value of 50s. per ton. Another shaft to the south is also giving good results. It is estimated that 50,000 tons of ore averaging 50s. is ready for extraction.

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Scientia non habet inimicum nisi ignorantem.

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REVIEW OF MINING

INTRODUCTORY.—This is the season of the year when London is wrapped in the Cimmerian gloom of carbonaceous fogs and when its denizens go to work amid an environment as depressing as a long-protracted second-class funeral. It argues the possession of keen vitality and pronounced mental resilience that anyone should take an interest in the share market, in "the future in the distance," or "the good that we can do." However, the valley of the Thames was infested by fogs when Cæsar fought Cassivelaunus and it behoves us to be cheerful, remembering that the sun is shining gladly somewhere else.

The new year has started with every promise of speculative activity; in January, 61 new issues were made, absorbing capital to the extent of £35,800,000, which is the highest on record for the first month of the year except January 1909, when it was £2,500,000 more. In the mining department 13 new ventures required £1,224,700, so that the demand was comparatively slight. In 1910, according to *The Investor's Guardian*, the number of new companies registered was 7184 as against 6373 in 1909. The amount of capital thus subscribed was £213,916,089, which is the highest for seven years. Mining and exploration registrations absorbed £29,491,009 as against £23,106,313 in 1909 and £53,035,117 in 1900, which coincided with a boom both in South Africa and Western Australia. Rubber issues in 1910 absorbed £44,046,045 and oil companies £34,302,337.

TRANSVAAL.—The official statistics for December being now to hand, it is seen that the total output of gold was 7,534,120 oz., as against 7,280,542 in 1909, and 7,052,617 in 1908. The increase is therefore 253,578 oz. or nearly 3½%. In money the gold was worth £32,002,912, the increase being a little over

a million pounds sterling. These figures tend to confirm the impression that the mining industry of the Rand has about reached its zenith of productiveness, and that it is in a healthy but not expansive condition. During the year the number of productive companies has fluctuated between 68 and 72, ending and beginning however with 71. The number of stamps at work has varied from a maximum of 9870 in June to 9736 in December. Coming to dividends we find a decrease, the total being £8,875,000 for 1910 as compared with £9,166,853 in 1909. Crown Mines decreased £216,014 and Ferreira decreased £285,000, the other decreases were relatively small. Among the increases were New Modderfontein with £95,000, Randfontein South with £100,000, Main Reef West with £56,250; Simmer & Jack with £75,000; moreover, dividends amounting to £115,546 were paid by Consolidated Main Reef, which was not among the dividend-payers of 1909. In the districts outside the Rand, the Nigel failed, but the Transvaal Gold Estates doubled its dividends. The outside districts contributed £238,737 in dividends. Of course, as anyone in the habit of reading these columns is aware, the dominant factor during 1910 was the scarcity of labour. Writers in the daily financial Press have varied optimistic expressions with attempts to shut their eyes to the basic condition underlying successful mining on the Rand, but facts are stubborn. It is unscientific to refuse to see them and to take account of them. During 1909 the supply of coloured labour ranged from 162,570 (plus 1908 Chinese) in January to 178,602 Kaffirs (but no Chinese) in December. In January the last Chinaman was repatriated. The highest labour supply was in May, when 183,964 natives were employed on the Rand. In February the number was 169,771. A

slight increase is shown at the end of the year but this increase has been inadequate for a demand that has grown as new mills have been started and fresh mines have reached the productive stage. At the last meeting of the Chamber of Mines, it was stated by the president, Mr. J. G. Hamilton, that the mines of the Witwatersrand had only 71% of their full complement of native labour, despite the recent aggregate increase of 20,000 hands. Six developing companies alone absorbed half the net increase. Yet he said that the prospects were favourable, in view of additional recruiting of natives in the Cape Colony and Natal. This is a cheering expression of opinion. Unfortunately the thought owes much to the wish. Of course, it is apt to be forgotten that there are other industries besides gold mining in South Africa, and with the industrial development of the country the demand for labour is felt in many directions; for instance, the construction of the Silati railway, the diamond and coal mines, municipal works, and agriculture. Moreover, the numbers do not quite indicate the conditions of affairs, because the extra efforts to recruit a supply from distant parts of South Africa have brought to Johannesburg a large number of natives of low efficiency. In order to overcome the lack of 'boys,' it has been necessary to employ machine-drills where stoping by hand was formerly in vogue, thus breaking more waste and reducing the average grade of the ore. The perfect stope-drill has not yet been invented, but in that direction lies the best hope of overcoming shortage of labour. Necessity is the mother of invention; it is exceedingly probable that the want so acutely felt on the Rand will lead to the introduction of a machine-drill more suitable for narrow stopes than any hitherto known. This hope is not unreasonable. Mechanical ingenuity is everywhere taxed successfully to replace unintelligent hand-labour. For instance, the general use of automatic machinery in the new City Deep plant has

eliminated native labour in favour of a relatively small number of skilled white workmen. This is a sign of the times and most significant, but it is only an expectation. The fact remains: a shortage of labour exists and hinders the expansion of the mining industry in the Transvaal.

RHODESIA.—The December output was a little disappointing after the recent successive monthly increases. This was due mainly to the Globe & Phoenix, whose output was worth £30,048 as against £72,938 in November and £65,334 in October, the decline resulting from the treatment of lower-grade ore. The Giant and Eldorado both did well, while the Selukwe and United Rhodesia show decreases. Thus the total output for the year was 604,518 oz. or £2,569,201, which is slightly less than in the two preceding years. Undoubtedly progress is being made in Rhodesia, but it is not reflected either in output or dividends. The official explanation is that "a large number of properties hitherto worked successfully by individuals on a small scale have been taken over by companies, and crushing has temporarily ceased pending development and the erection of up-to-date machinery." This is true in part, but it is not the whole truth, as we show on another page.

Rhodesia Esperanza had a spectacular rise on January 27 owing to the receipt of a cable-gram announcing the discovery of a wide gold-bearing formation resembling that of the Eldorado, but the rise was not maintained. This is a company of only 15,000 shares and the episode has no large significance, although indicating that enterprising operations may make money without using large sums.

The test crushing on Shamva ore is reported to have given an average yield of 10.1 dwt. per ton from ground that was estimated to yield 8.35 dwt., after reducing high assays, or 16.27 dwt., including the high assays. Thus the crushing was a test of the method of estimation and not of the average contents of the

on in the mine, as seems to have been hastily inferred. The average of the ore, after making a reduction for abnormal assays due to sporadic occurrence of free gold, is given as 373 dwt. per ton. It is on this basis that the Shamva deposit is to be exploited successfully as a large deposit of low-grade ore.

WEST AFRICA.—The December output was practically the same as in November, so that the total for 1910 was only 185,493 oz. worth £755,985, as compared to 235,972 oz. in 1909 and 297,366 oz. in 1908. The result is depressing, despite the well known fact that production is delayed at many of the best mines pending further development and changes in the mill equipment. If the current year does not see a decided increase of output it is unlikely that the public interest in the Gold Coast will be maintained. Much is expected from the Prestea group, where crushing is to commence next month. The Ashanti Goldfields exhibits an increase during the last three months and having regard to the recent underground developments there is good reason for expecting a large production from this group of mines. For 95 ft. the ore found on the ninth level averaged 3 oz. per ton for an average width of 6 ft., but the drift is in poor stuff now.

Nigerian tin enterprises have been stimulated by the high price of tin and by the news regarding railway construction. The local Government has agreed to build a branch from the Baro-Kano railway to the Bauchi district. The Niger Company agrees to make good half of any deficit in the operation of the railway for 10 years. The branch line will be 100 miles long, from the Kaduma river, at Rigachikum, across the Province of Zaria, to Leri, at the foot of the Bauchi plateau. This railway, of course, will facilitate the transport of machinery and the export of tin concentrate. Three hydraulic plants are said to be ready for delivery; they are sectionalized so that the biggest piece does not weigh more than 500 lb. Two of these equipments are for the Jaga

and the third for the Lucky Chance mines.

AUSTRALASIA.—The discouraging reports from the Golden Horse Shoe and the Great Boulder, on top of the recent Associated fiasco, naturally have depressed the shares of the big Kalgoorlie mines and tend further to suggest the fear lest their days of profitable production are numbered. Nevertheless, it must be remembered that in some cases, as in the Perseverance, the conditions in the bottom levels are better than they were at an intermediate horizon such as 1300 to 1750 ft. It remains for the companies owning decadent mines to perpetuate their organization by acquiring mines elsewhere, as has been done by the Oroya, Lake View, and Northern Blocks. The Bullfinch issues have declined on a dull market. Nothing of moment has been found outside the Bullfinch itself, work having been suspended until February 3, owing to the strike. Reports of interested parties have ceased to cause palpitations. Railroad construction is nearly completed and a water-supply is now available from the Government pipe-line. Our Melbourne correspondent makes sensible comments.

We discuss the Waihi collapse elsewhere. The recent report refers almost entirely to the 9th level but the deepest level is the 10th, on which results so far are equally disappointing. Of course, now that the future of the mine is so uncertain the purchase of shares must be made on a frankly speculative basis. Orebodies that 'peter out' may 'make' again in depth and in this case it is a question of big lenses in a lode-channel rather than of a continuously productive vein. Evidently despite the good intentions of the management, the true nature of the ore deposit is but little understood even by those financially interested in the mine.

A dividend from the Broken Hill Proprietary, the cessation of labour troubles, and the news of a copious rainfall on the Barrier have encouraged holders of Broken Hill issues.

The new agreement for $4\frac{1}{2}$ years ought to ensure industrial peace and the agreement of the Broken Hill Proprietary company to pay the same rate of wages as the other companies in the district is significant as indicating that the parent company is no longer dominant. Our Melbourne correspondent says that there is talk of the Proprietary starting on day-shift, which would further increase the chances of employment. The increase in wages makes the Barrier one of the best labour centres in Australia and eliminates the danger of a scarcity of workmen. The oil-shale deposits of Tasmania, near Latrobe, are to be developed. A favourable report has been made by W. H. Twelvetrees, the Government geologist. At Sydney it is rumoured that H. C. Bellinger will resign as general manager of the Great Cobar [but this is denied at the London office]; the new mine superintendent is J. N. F. Armstrong, formerly of Broken Hill Block 10.

MEXICO.—Great activity is reported from Pachuca. The new La Blanca mill has attracted attention by exemplifying the most recent ideas in cyanidation as adapted to Mexican ores; the chief points are concentration on tables, followed by tube-mills of ample capacity, Pachuca tanks, and Moore filter-presses. The recovery is said to be over 90% of the silver and 96 to 98% of the gold.

Mr. F. J. Fournier has joined the board of directors of the Mexico Mines of El Oro, so that two of the Dos Estrellas directors have replaced Messrs. Bayliss and Shaw. This would seem to presage closer relations between the two companies and may lead to a consolidation of the ground extending from the Mexico to the two Estrella claims. The intervening territory, covered by the two Nolan claims and the Somera II, is controlled by the same group. We are glad to learn that Mr. Fergus L. Allan, who resigned as superintendent a few months ago, on account of ill health, has become manager of the Mexico mine, for a time at least. This is an excel-

lent arrangement. It is probable also that a report on the mine will be made shortly by an independent engineer of high reputation. The closing of the south shaft for repairs has depressed the shares, it being necessary to supplement the gold ore supply from the dump.

INDIA.—At the Mysore mine the ore reserve is increasing, and at several points on the bottom levels the gold content is high. For instance the latest assay of the lode at 2790 ft. in Tennant's section gives 37 dwt. over 4 ft. The reports from Ooregum, which has been depressed lately, show that developments are improving somewhat, though the veins are narrow; at the 4010 ft. level in Bullen's section the vein is 15 in. thick and averages $1\frac{1}{4}$ oz. per ton.

CANADA.—Our Toronto correspondent gives the latest news concerning Porcupine. We are enabled to state that on the 28th inst. Mr. C. A. Moreing, accompanied by Mr. J. T. Hollow, sailed for New York, on his way to Porcupine, in the interest of the North Ontario Syndicate, which has a capital of \$400,000, of which \$100,000 has been issued, with 3s. paid up. Among the members of this syndicate are W. K. D'Arcy, of the Mount Morgan, C. Kerr & Co., Russell Grant & Co., G. H. Raw, Charles Kaufman, and E. W. Janson. We await with interest the outcome of this enterprise. If it leads to business a strong stimulus will be given to speculation in this new goldfield.

UNITED STATES.—Our correspondents at New York and San Francisco send interesting letters. The copper figures appear on the page devoted to current statistics.

VARIOUS.—We hear that Messrs. Bradley and Mackenzie, of San Francisco, have acquired the Bonanza mine on the Atlantic side of Nicaragua. The Leonesa mine, of the Oroya Exploration Co., is doing well, awaiting the completion this year of the 20-stamp mill. Cablegrams announce an important discovery at the Butters Salvador mine, on the 700-ft. level of the Letona workings, the ore assaying 2 oz. gold for a width of 10 feet.

STATISTICS

MINING PRODUCTION IN ENGLAND AND WALES, 1910.

	Nov. 31 Tons	Dec. 31 Tons	Jan. 31 Tons
Coal	65,872	65,872	65,872
Iron	6,896	6,896	6,896
Afloat from Chile	4,250	3,600	3,100
Afloat from America	7,325	7,325	7,325
Total	83,193	83,193	83,193
In Rotterdam	6,800	7,600	7,600
Total	15,000	15,000	15,000

AMERICAN COPPER PRODUCERS' ASSOCIATION.
In Tons of 2,240 lb.

	Deliveries			Stocks at end of month
	Produce Tons	Foreign Tons	Total Tons	
November 1910.....	58,792	58,792	58,792	58,792
December 1910.....	58,792	58,792	58,792	58,792
January 1911.....	51,650	18,785	23,753	42,538

PRODUCTION OF GOLD IN THE TRANSVAAL.

	Transvaal	Elsewhere	Total	Value
1910	Oz.	Oz.	Oz.	
July.....	610,664	28,050	638,714	2,713,083
August.....	623,129	26,140	649,269	2,757,919
September.....	621,311	25,588	646,899	2,747,853
October.....	627,445	25,702	653,147	2,774,390
November.....	617,905	24,686	642,591	2,774,390
December.....	616,668	24,327	640,995	2,722,775
Totals, 1910.	7,228,588	305,532	7,534,120	32,002,912
January 1911.....	625,862	25,201	651,027	2,765,386

COSTS AND PROFITS OF COAL.

MONTH.	Tons	Yield per ton	Costs per ton	Profit per ton	Total profit
1910		d.	s. d.	s. d.	
January.....	1,754,140	27 7	17 0	10 7	924,275
February.....	1,614,730	28 5	17 6	10 10	874,746
March.....	1,767,059	27 6	17 1	10 4	913,759
April.....	1,763,104	28 1	17 6	10 5	927,244
May.....	1,785,821	28 1	17 6	10 5	958,547
June.....	1,766,737	28 1	17 9	10 5	921,136
July.....	1,814,686	28 1	17 8	10 4	937,456
August.....	1,834,105	28 1	17 8	10 6	941,111
September.....	1,835,647	28 3	17 11	10 4	942,330
October.....	1,868,718	28 0	17 9	10 3	941,111
November.....	1,800,371	28 6	18 0	10 7	951,773
December.....	1,827,423	28 1	17 9	10 5	952,574

MINING PRODUCTION IN ENGLAND AND WALES, 1910.

	Gold mines	Coal mines	Diamond mines	Total
January 1911.....	180,103	8,528	8,068	196,699
February.....	178,027	8,367	8,362	194,756
March.....	178,602	8,354	9,939	196,895
January 31.....	183,268	8,357	9,991	201,616

January 1911

Year 1909

Year 1910

£177,708

£2,083,901

£2,104,858

PRODUCTION OF GOLD IN RHODESIA.

MONTH.	1908	1909	1910
January.....	£190,688	£204,666	£227,511
February.....	191,635	192,497	200,388
March.....	200,615	202,157	228,185
April.....	212,915	222,700	228,213
May.....	224,867	225,032	238,588
June.....	224,920	217,600	217,600
July.....	228,151	225,234	195,233
August.....	230,792	228,296	191,423
September.....	204,262	213,249	178,950
October.....	205,466	222,653	230,777
November.....	196,668	236,307	230,777
December.....	217,316	236,307	199,500
Totals	2,526,007	2,623,788	2,568,201

PRODUCTION OF GOLD IN WEST AFRICA.

MONTH.	1909		1908		1907	
	Oz.	Value	Oz.	Value	Oz.	Value
January.....	17,357	70,699	22,817	91,112	24,844	98,808
February.....	16,976	68,469	21,403	86,210	25,354	101,813
March.....	17,627	71,954	23,186	93,556	26,726	106,243
April.....	16,363	65,000	21,491	88,071	25,108	100,234
May.....	16,590	68,355	25,104	100,056	24,227	97,091
June.....	17,194	70,988	17,340	70,561	23,360	92,717
July.....	15,564	58,551	17,331	70,523	24,587	97,829
August.....	13,921	57,713	17,766	71,614	25,195	100,629
September.....	11,497	47,746	18,125	72,963	25,123	99,689
October.....	13,341	55,046	15,957	65,813	23,781	94,674
November.....	14,021	57,658	17,882	73,824	24,437	98,214
December.....	15,042	61,737	17,570	71,332	24,624	98,262
Totals	185,493	755,985	235,972	955,635	297,366	1,186,342

PRODUCTION OF GOLD IN WESTERN AUSTRALIA.

MONTH.	Export oz.	Mint oz.	Total oz.	Total value
Total, 1910	363,496	1,209,856	1,573,352	6,682,042
January 1911	17,463	102,035	119,498	507,592

GOLD, AUSTRALASIAN GOLD PRODUCTION.

	January	1910	1909
Queensland.....	£102,810	£1,840,337	£1,916,468
New South Wales.....	58,350	803,727	803,727
New Zealand.....	195,783	1,896,322	2,006,910
Victoria.....	134,000	2,422,700	2,897,340

SALES OF LONDON AND AUSTRALIA.

	1910	Value	Average
Year 1910.....	6,102	£619,000	£103,166
January.....	215	£23,778	£110,300
February.....	200	£21,000	£105,000
March.....	245	£26,000	£107,000

EDITORIAL

OUR Parisian contemporary *Financia* has an interesting article on 'Les grosses pepites d'or à la Lucette,' from which it appears that the mine of La Lucette is yielding some specimen ore at a depth of 230 metres. The conclusion reached by the writer of this cheerful article is that 'L'or augmente en profondeur en France.' We seem to have heard a similar story long ago, in Colorado, in Australia, and in Mexico.

AT THE TIME of going to press we learn that the Consolidated Gold Fields of South Africa is to issue £1,250,000 of 6% second preference shares. The rumour depressed the share market. We believe that some of this capital is to be used for acquiring oil lands in Tampico, Mexico, on options held by Mr. J. H. Hammond. This is evidently part of the policy of expansion rendered necessary by the *passé* condition of the Gold Fields investments in the Transvaal.

WE PUBLISH a letter warning persons participating in Nigerian tin ventures. The excellent prospects in that region have been used as an excuse for several irresponsible schemes. For instance, no less than £200,000 was subscribed for a company based on an elaborate report, containing ample details of bore-holes and sampling. But it was a fraud. No tin was found and even the garnet was insufficient to explain how the criminal blunder originated.

THE ENGAGEMENT of Mr. G. A. Richard, the manager of the Mount Morgan, to inspect the Waihi mine, is satisfactory as far as it goes, but it falls short of the requirements of the case. Mr. Richard is a highly competent and experienced manager,

and if it were a question of a system of exploitation, of equipment, or of general operations, he would be an excellent adviser, but what the conditions at the Waihi require is a mining geologist competent to ascertain the facts connected with the impoverishment of the lower levels and able to diagnose those facts with a view to trustworthy advice. The directors are wasting time.

IT WILL be remembered that John Taylor & Sons lately decided to use the short ton of 2000 pounds at their Indian mines from the first of January, so conforming to general usage in connection with gold-mining. Unfortunately, however, they have not adopted the fine ounce for the gold output, and the reports of the monthly production are still given in bullion, the value of which can only be surmised.

AMONG the exaggerations evoked by the effort to boom Rhodesian shares is the statement, in the *Sunday Times* financial columns, that the Globe & Phoenix is as deep "as any quartz mine in the world." This mine has attained a depth of 2600 ft. vertically, which, of course, is shallow when compared to the Victoria Reef Quartz, at Bendigo. The shaft of this Australian mine is 4634 ft. deep, and it is to be sunk 200 ft. more in order to cut the saddle-reef that was worked profitably in the neighbouring New Chum Railway mine at a vertical depth of 4000 ft. Of course, scores of mines yielding gold-bearing quartz are deeper than 2600 ft. Perhaps the amateur technologist who writes of the "quartz mine" in Rhodesia has some idea that the gold ore of the Rand, of California, or Australia, is not quartzose or chiefly quartz. Naturally, so long as the term 'reef' is applied to irregular ore-bodies that do not even outcrop, and 'banket'

is used to describe a formation that is not a conglomerate, and geology generally is employed as a cloak for ignorance, the intelligence of the public as regards mining is not likely to be greatly illuminated.

WE NOTE the publication, on January 7, of a cablegram from the Giant Mines, stating: "Reef in cross-cut below No. 6 level now over 80 ft. still in good ore. Value over all so far 18 dwt." Since then no further news has been made known, although it would seem to the onlooker that it would be interesting to know if the orebody is wider than the 80 feet mentioned and it would be even well to ascertain how long this orebody is; in other words, whether it has other dimensions besides this one of width. We are reminded of that celebrated expert Colonel Doolittle, who flourished at Poker Flat in the days of a forgotten boom. It happened that a 'strike' was made on a mountain at the head of Mineral creek and the town was wildly excited about it. Everybody wanted to know the Colonel's opinion. After much persuasion—of a liquid nature—he went up the hill and inspected the discovery. On his return a committee of leading citizens waited on him at the Last Chance saloon. "Have a drink, Colonel." "Don't mind if I do." He did. "What do you think of the strike?" "Well, boys, it's fine, and no mistake; the ore is 17 feet wide." "Hurrah! for the Colonel. Have a drink?" "Yes, the same; a little more sugar." A pause. "Yes, boys, it is 17 feet wide and three inches long." *Tableau. Exeunt omnes.*

Labour in Rhodesia.

This is part of the great question confronting the mining industry of South Africa, and in a general way it is a problem of worldwide significance, for if the mining industry of today differs from that of the ancient world in respect of skill and machinery, it differs most of all in the fact that the *antiguas* were dug with a

labour that cost next to nothing. Forced labour made mining without machinery as cheap as the work done more skilfully today with highly-priced workmen. The problem of the modern world is to get willing and intelligent labour at a cost that does not prohibit profitable exploitation. In *The Economist* of January 21 we find a sensible article on 'Mining in Rhodesia,' written evidently by an experienced observer on the spot. Manifestly his information is not 'inspired' in a sinister sense but is actuated by a desire to give trustworthy information. We are able to supplement what he says. According to the Labour Bureau the supply is persistently inadequate. In July, August, and September 12,097 'boys' were required and only 4079 were supplied; in October and November the demand was 11,367, but the number supplied was 1663. The total employed in September was 40,187, but of these only 24,000 were at work on productive mines. This indicates the large proportion of prospecting work now in progress. The manager of a mine usually engages native labour through a contractor, who is experienced in aboriginal ways and prejudices. Not many of the technical men in charge of mines or even departments have sufficient knowledge of the native to be able to deal with him direct and successfully. This explains why the contractors are allowed to make such handsome profits, which, incidentally represent an added burden on the industry. On the other hand the native, owing to tribal custom, prefers to have one 'boss' and does not understand a control that is distributed among several, such as the superintendent of the compound, with whom he comes in contact as soon as he ceases work, the various shift-bosses, the white miners in charge of levels, and finally the big man with whom, as general manager, the native has no relations except when he may be condemned to serious punishment. Apart from the scarcity or inefficiency of native labour there exists a further difficulty, namely, a concomitant scar-

city and inefficiency among the white men who are required to direct the coloured workmen. The mere increase of native labour is not enough, the mere increase of white labour is also not enough, it is imperative that the latter shall be competent to direct the former to economic purpose. At present the Rhodesian mining districts are overburdened with an economically worthless kind of white man colloquially called a 'waster,' 'sun-downer,' or 'weary Willie.' Such men work for one month and are drunk for a week. They are incompetent and unreliable. Their conduct with the blacks leads to trouble in the compound, causing desertions. Not that we argue in favour of an entire replacement of black by white labour. That, when it comes, will come with extreme slowness and not without many disappointments. At present it remains to make the best of the material available, that is, instruct the natives by means of competent white overseers. But these and other details while vividly seen by those who are in charge of operations are lost to the man in London. The shadow of the Stock Exchange falls across the veldt, obscuring the essential facts, hiding the truth, and magnifying the high lights of the landscape.

The Modderfontein B Mill.

In our November issue we gave some notes concerning recent progress in cyanidation on the Rand. Since then much useful work, in the way of practical research, has been accomplished. Attention has centred on the Modderfontein B mill, which is being equipped with the latest devices, under the direction of Mr. H. Stuart Martin, the consulting engineer to the company, and Mr. F. L. Bosqui, a specialist in cyanidation. Thus the new mill exemplifies the combination of the best ideas developed in South Africa and Western America. As consulting metallurgist Mr. Bosqui has shown good sense as well as skill in taking advantage of so good an opportunity

to combine the best features of two schools. Science knows no nationality. That might well be the motto of the Modderfontein B, whose new mill will have 80 stamps, each weighing 1750 pounds, with a duty of 20 tons per day. This result, comparable to the work achieved by the East Rand Proprietary, will be due to the use of screens of 3 mesh or 0.27 inch aperture, supplemented by the employment of an eliminating screen between the feeder and the mortar-box. This 'eliminating' screen will cause a large proportion of the fine to 'by-pass' the mortar-box for delivery direct to the tube-mills. There are five of these, each being of 5½ feet diameter and 22 feet long. The battery is without amalgamation plates, the pulp going to Robeson centrifugal pumps and thence to the thickening and classifying cones in front of the tube-mills. The Caldecott cone and diaphragm are to be used, with the addition of a small auxiliary cone which catches the + 60 overflow from the large cone, co-operating with the latter in sending the thickened pulp direct to the tube-mills. The fine sand by-passing the tube-mill joins the tube-milled product and runs to stationary amalgamation plates, of which there are six (5 by 12 feet) for each tube-mill. The tailing from the plates is then elevated by another centrifugal pump to a classification system by means of which, firstly, the particles that are insufficiently ground are returned to the tube-mills, and secondly, the slime is separated from the sand in the final pulp before going to the cyanide annex. Thus the orthodox tube-mill 'circuit' is discarded in favour of a double-pumping system. The clean sand from the classifying cones runs to a Butters & Mein distributor, which distributes the sand in a collector previously filled with water and provided with an overflow rim. Here again we have a system formerly rejected by all the Rand 'groups' except the Consolidated Gold Fields. The slime overflowing from the classifying cones goes to the vacuum-

filters of the Butters plant, the enriched solution passing finally to Merrill precipitation presses. The reader who has followed us thus far will now note: (1) The absence of battery plates. (2) The use of an auxiliary cone, so that all particles of proper size go at once to the tube-mill. (3) A small cone is added at the discharge end of the mill to take the bulk of the water and fine sand; thus, by adjusting the underflow, all the fine sand goes to amalgamation plates with the requisite amount of water, obviating the necessity for fresh water to thin the pulp going to the plates. (4) The use of one system of plates, and these stationary. It has been proved that the shaking system is not necessary for a properly tube-milled product. This departure is based on the tests made by Mr. F. A. G. Maxwell, of the Randfontein Estates, to whom much credit is due. We may add that stationary plates are now being used after tube-mills in the Wolhuter and the Knight Central mills. (5) Small hydraulic cones in series are employed for the purpose of sending only the largest particles back to the tube-mills. (6) Slime separators, with a hydraulic device, replace the crude system in vogue on the Rand of filling a sand-vat with a hose. Of course, the Caldecott sand-filter was a big step in the right direction, but the method now mentioned is expected to do even better. (7) The vacuum-filter is followed by zinc-dust precipitation. (8) The Homestake smelting method of cupelling the briquetted precipitate has been adopted, instead of the Taverner method. Of these devices and improvements, we are most impressed by the introduction of a screen between the feeder and the battery. Heretofore the grizzly has relieved the rock-breaker or crusher from doing unnecessary work on ore already small enough, but no one seems to have applied so intelligent a principle to the product from the crusher before it enters the mortar-box. Obviously the fine stuff that finds its way under the stamp serves as a

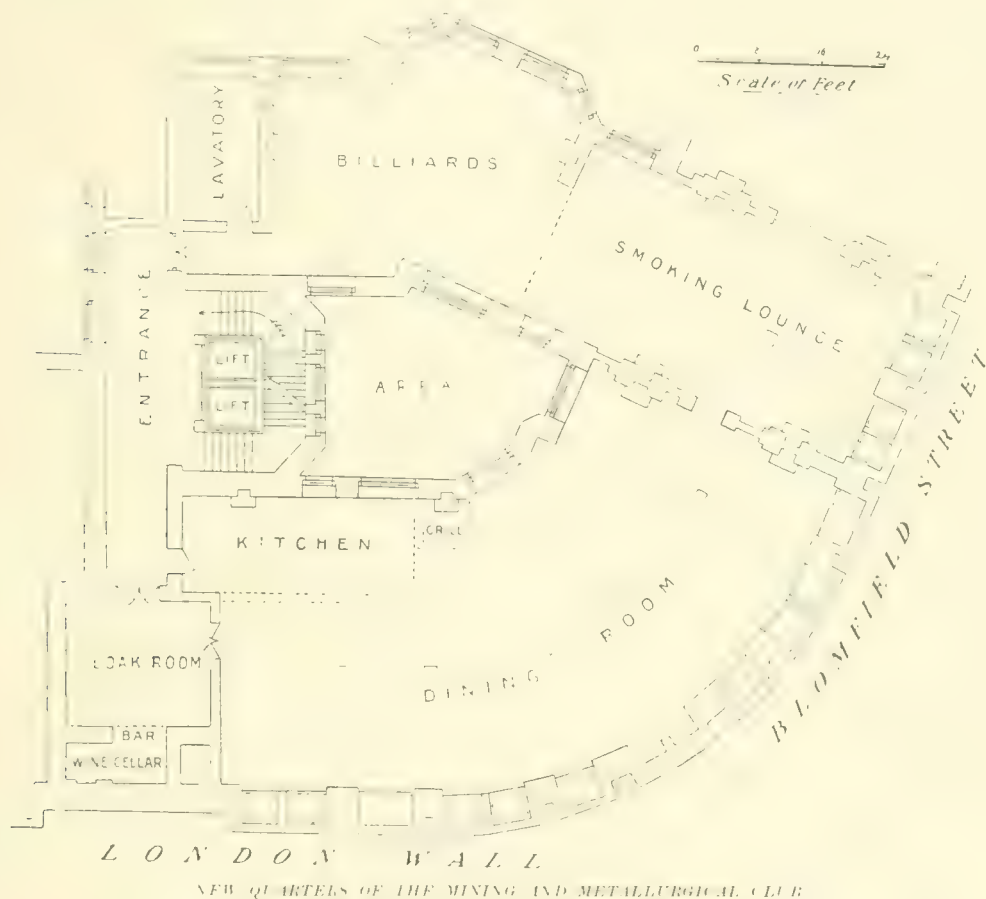
cushion weakening the impact of the shoe on the ore lying upon the die. Not only is this fine stuff subjected to unnecessary reduction but it impedes seriously the work to be done by the falling stamp. The 'eliminating' screen is a good idea, especially for ore that is not sticky. On the whole, we have reason to believe that the Modderfontein B mill will represent the best metallurgical practice available today for the peculiar conditions obtaining on the Rand.

Mining and Metallurgical Club.

It gives us keen pleasure to announce that arrangements have been made for the leasing of comfortable and commodious quarters in the City. The establishment of the Club at the St. Ermin's Hotel, in Westminster, proved unsatisfactory and it seemed that a most useful enterprise would die of sheer inanition. But the start made in the West End indicated that such a Club would meet with support and filled a want strongly felt by the members of a nomadic profession. The Club already has a membership of 650 and further accessions are being made daily. With the acquisition of suitable quarters in the heart of the City, the success of the undertaking is assured. We give herewith a sketch showing the proposed new site, on the sub-ground floor of No. 3 London Wall Buildings. This office building is owned by Wernher, Beit & Co., and it is to their good-will that the Club now owes the opportunity to obtain the requisite space on reasonable terms. The rooms extend over 6000 square feet, facing on London Wall and Blomfield Street. An attractive dining room, with a kitchen and grill, adjoins a general lounge and a billiard room. All the ordinary conveniences are available. Luncheon and dinner will be served, arrangements having been made with competent restaurateurs. It remains to say that this new departure is enthusiastically supported by all to whom it is known and the initiative is largely due to the

public spirit of Mr. Sidney Farrar, the President, who has been energetically aided by Mr. C. McDermid, the Secretary. In order to furnish these new quarters about £2000 must be subscribed, but this ought to prove easy now that Mr. Farrar himself has offered to subscribe £500. We expect to refer to the subject again in our next issue; for the mo-

The secretary describes it as too technical for the comprehension of the shareholders, but if it eludes the intelligence of the average man it will be on account of the English employed by the translator. Thus *une cheminée montante*, plainly a 'rise,' is translated as "a rising pipe"; *on fait 4, 5, ou 6 essais du font de taille* is translated "4, 5, or 6 assays are



ment we are content to give the news and to express a strong conviction that this Club is destined to play a most useful and helpful part in the life of the mining profession.

Translating a Report.

We refer elsewhere to the report of Mr. Henri Kuss, which is issued, with a translation, by the Golden Horse-Shoe company.

effected from the face of the drive." Speaking of inferences made from assays Mr. Kuss says: "*On attribue ensuite au minerai extrait entre deux fronts de taille successifs, distants de 6 pieds, la moyenne des teneurs obtenues à ces deux fronts de taille*" and he is represented as responsible for this rigmarole: "To the ore taken out from between two successive 6-feet distant sides is then attribu-

ted the average of the grades by the sampling of these two sides." He has previously referred to the sampling of the ore at intervals of 6 feet as a drift is being advanced and he really says: "Therefore the ore extracted between two successive headings 6 feet apart is given the mean of the values ascertained by the sampling of the two headings." Referring to the inclusion of ore in ground not proved by both an upper and a lower level, Mr. Kuss speaks of "*les sections tracées par une voie de fond et une voie supérieure au moins*," and he is represented as saying "the sections opened up by a deep drive and an upper drive at least," which may convey a glimmering of sense, but that is all. *Minerai développé* is translated "opened up ore" and *des développements et des extractions* is given as "the opening up and ore raising work." "*Ainsi, à chaque niveau, admettait dans les réserves le minerai dont la voie de fond avait été tracée, et on n'allait pas au delà.*" This is translated: "Therefore, on each level, ore was taken into the reserves of which the drive had been effected, and one did not go any further." Here *niveau* corresponds to 'lift' and *voie de fond* to 'lower level'; for the rest, the translation is worthy of a Chinaman. The word *majoration*, important in Mr. Kuss's argument, is used in the English version, much to the perplexity of the reader. It is a term borrowed from high finance and refers to the adjustment of figures to suit conditions, as in 'watering' stock. 'Juggling' would be too strong; 'watering' has a less sinister meaning. When a manager adds figures representing tons of waste or low-grade stuff to a previous estimate of ore in order to bring his results into accord with his anticipations, he is performing 'majoration.' The compositor uses the term 'justification' to cover the adjustment of the spaces between the type which he sets for the printer. Thus 'majoration,' 'justification' and 'rectification' convey much the same idea, except that the first

suggests an alteration by magnifying the attractiveness of the figures. We are obliged to Mr. Kuss for 'majoration.' It is a comfortable word. To return to our subject. The translation of his report conveys an entirely erroneous impression. The man who reads it without the help of the original will wonder whether his brain is tired, his liver out of order, or his intelligence atrophied, and he will throw the document in the fire to hide his perplexity. We hasten to re-assure him. He is not bereft of intelligence; not he, but the ignoramus who made the translation. The first part is better translated than the second, as though time had pressed. We have said enough. On page 3 of the report it is stated that a double reduction of an estimate "*a préoccupé le Conseil*" and this is translated as "has given the board to think." We move to amend by inserting the word 'furiously.'

Ore and Dividends.

The Globe & Phoenix publishes an estimate of the ore in reserve on December 31, 1910, showing an increase of 4567 tons as compared to June 30. The total gross value is £1,268,755. The average contents are given at 33'9 dwt., as against 32'259 dwt. six months earlier. The three places of decimals are not necessary; all of them could be omitted without loss of significance. Unfortunately some persons will be simple enough to regard the decimals as indicating a refinement of accuracy, when they happen only to be the result of a simple arithmetical division. If the ore in the Globe & Phoenix mine proves in the future to have contained 1½ ounces, the result will be properly regarded as a tribute to the accuracy of the gentleman responsible for the estimate now published. And we would think that cheerful eventuality at least as probable if the three decimal places were omitted. Such needless refinements only obscure the fact that real information is lacking, for it is obvious that whether the ore contains 32 dwt.

or 32½ dwt. or 32'259 dwt. is of no particular consequence unless we are also informed what proportion of it will be extracted in the mill and what the total cost of mining and milling is to be. To tell the average shareholder that he has £1,250,000 in the form of ore underground does not convey much to him; or it may convey a great deal that is erroneous, for it does not mean that £1,250,000 is divisible in dividends. What the shareholder needs to know is what amount of profit is assured for distribution in the form of dividends. The *Globe & Phoenix* reports do not state that; indeed, we doubt if either the chairman or the secretary of the company possesses the information. Of course, they ought to have it and they ought to give it promptly to the shareholders. In default of such distribution of essential data, we shall try and dig them out of the reports. First, as to extraction: The only mention of this fundamental factor is to be found in an interim report for the half-year ending June 30, 1910, where it is said that "the residues were very high. These have been stacked for future treatment." Metallurgical difficulties are known to have hindered milling operations. The necessary information has not been published. Making allowance for the skill of the men in charge, let us assume that the extraction is 85% of the assay-value. Then the £1,268,755 in the ore becomes £1,078,441 in bullion. But this means nothing until we deduct the cost of the series of operations by which the gold is extracted. During the first half of 1910 the total cost was 38 shillings per ton, but this was abnormal. In 1909 the cost averaged 28s. Applied to 178,221 tons, the total is £250,509. Deducting this from £1,078,441 there remains £827,932. Thus, on the amount of ore stated to be proved in the mine, the shareholders have about £825,000 available for dividends. This looks very different from £1,268,755. With a market valuation of £2,400,000, the ore available for

dividends represents 34%, so that the speculator who holds *Globe & Phoenix* shares is taking his chances on 66% of his capital. This does not allow for any interest. A yield of 12% for three consecutive years would swallow all the profits assured, without the return of capital. More money is lost by over-valuing rich mines than by speculating on worthless holes in the ground.

The Panama Canal.

The latest bulletin issued by the American Institute of Mining Engineers contains a record of the observations and opinions contributed by the engineers who visited the Canal in November 1910. Among the participants in the discussion are many known on both sides of the Atlantic and in South Africa. The whole mass of diverse expression has been presented in agreeable literary form by the masterly editorial hand of the secretary, Dr. R. W. Raymond, and we are thus given a succinct account of the greatest engineering feat of the modern world. The canal is being built at an elevation of 85 feet above sea-level with an average width of 649 feet for a total length of 31 miles. Two natural difficulties obstructed the construction of a canal across the Isthmus of Panama; these were the Chagres river and the Culebra hills. To overcome the first a big dam is being built; to penetrate the second a huge cut is being excavated. Destructive action by the Chagres river and 25 smaller streams, when in flood, is to be prevented by the construction of the Gatun dam, which is 8040 feet long, with slopes of 1 in 10, a base 1900 feet wide, and a height of 115 feet. This barrier will have the effect of covering a former swamp with a lake of 164 square miles through which vessels will be able to proceed at full speed for a distance of 24 miles. The Gatun dam and locks at the Atlantic terminal are 31 miles from the corresponding dam and lock at Pedro Miguel on the Pacific side. The Canal has a minimum width of 300 feet through

the Culebra cut. Elsewhere the bottom-width ranges from 500 to 1000 feet. The most spectacular feature of the Canal work is the Culebra cut, which has a maximum depth of 312 feet and a total length of 8.2 miles. The rock traversed disintegrates on exposure, causing landslides, which have largely increased the quantity of material to be removed. But this difficulty is being steadily overcome. No less than 80,000,000 cubic yards of rock had to be removed, and this is being done at the rate of 1,500,000 cubic yards per month or 60,000 yards daily. The Gatun dam will absorb 18,000,000 cubic yards, so that the excavation at one place facilitates construction at another. The Culebra is being dug with dredges having close-connected buckets of $2\frac{1}{2}$ cu. yd. or $67\frac{1}{2}$ cubic feet capacity. The total work in concrete, for locks and dams, amounts to 4,500,000 cu. yd. The water-power rendered available by the Gatun dam will be used, through electric transmission, for the operation of the machinery of the locks. The entire system of operations is expedited by the efficient use of the Panama railway, which has 350 miles of track, and is well equipped. This railway furnished the first requisite for so big a scheme of construction. When completed the new locks of the Panama Canal can cope with a tonnage of 80,000,000 per annum, permitting the largest vessels to pass from the Atlantic to the Pacific in 10 or 12 hours. About 25,000,000 tons pass through the Suez Canal annually, and 40,000,000 through the Sault Ste. Marie. The entire cost of the undertaking is estimated at \$375,000,000, of which \$50,000,000 was paid to the French company and \$20,000,000 was spent on sanitation. With maintenance at \$3,000,000 per annum and interest at 4%, the annual gross receipts must be \$18,000,000 in order to make the enterprise self-sustaining. Various suggestions have been made, including the proposal that the entire cost be charged to 'glory,' in other words, that the American people assume the debt, with a

view to stimulating the coast-wise trade now smothered by the great trans-continental railway companies. The Canal is to be completed before 1915. These are the bare facts outlining the magnitude of the achievement. It includes five great features: sanitation, transportation, excavation, construction, and organization. All thoughtful observers write in praising the splendid work done by the Sanitary Department, under Dr. W. C. Gorgas. Mr. Gardner F. Williams testifies that during the week he spent on the Isthmus he did not see a single mosquito. It has been a fine thing to "make the dirt fly" but it was essential first to make the mosquitoes 'go.' Now 30,000 people are being employed and yet the death-rate on the entire Canal Zone, including the towns of Colon and Panama, is the same as that of Providence, Rhode Island, a typical healthy American city. And yet the party of mining engineers arrived at the Gatun dam just after a rainfall of 3.28 inches in 59 minutes. The annual precipitation on the Isthmus ranges from 60 to 120 inches. Evidently the visitors were impressed by the disciplined energy of those at work. They noted the vigour and hopefulness of everyone employed. Tropical laziness has given way to the willing activity of a more bracing zone. A fever-breeding swamp has been made the arena of highly productive labour. The Panama Canal affords a great lesson in this respect. Sanitation must precede efficient labour. Thanks to a thorough treatment of this preliminary necessity the work at Panama is being done as cheaply by the Government as it could be done by private contractors. Charge of the work was first given to experienced railway engineers but owing to recurrent friction the organization was finally placed under the War Department; since then the Army officers, headed by Colonel Goethals, have directed the vast operations with conspicuous success. The *moral* of the organization and the *esprit de corps* of the men are splendid. On the whole,

as Mr. William Kent suggests, the Panama Canal illustrates engineering as "the science and art of overcoming the resistances of nature, including human nature." It is worthy of the American people. "It is a big job, handled by big men, in a big way."

The New Parliament.

Another House of Commons having been elected, it becomes interesting to analyse the composition of the First Chamber of the National Legislature. It consists of 670 members. According to an authentic list it appears that 206 of them were educated at Oxford or Cambridge University, the first claiming 130 and the second 76. Fully 350 members have had a university training. Despite the growth of Liberalism and the greater opportunities afforded to the less privileged portion of the community to be elected to Parliament, it is apparent that the socially dominant class is extremely well represented. Thus no less than 49 men are labelled "Eton and Oxford" and of these 40 are Conservatives, only 9 having proved sufficiently independent of their scholastic environment to be Liberals. Eton alone can claim 102 men, while the four leading public schools—Eton, Harrow, Rugby, and Winchester—are credited with 163, or nearly 25% of the entire House. Nevertheless, it is a remarkable fact that 82 men are described as being "self-taught" or as having had a "private" education. The nine representatives elected by Universities are all Conservatives. Coming to classification according to "profession or occupation" we find no less than 88 "country gentlemen," of whom 61 are Conservatives, 25 are Liberals, and 2 are Nationalists. Indeed 'country gentlemen' constitute an important element, ranking second only to the barristers, of whom there are 102, supplemented by 37 solicitors. Thus the lawyers number 149, or over 22%. Only recently a gentleman signing himself 'Lieut-

tenant-Colonel' wrote to an evening paper to protest against the excess of lawyers, but we find that those who designate their occupation as 'Army' number 45, and there are at least twice as many more who have given military service of one kind or another. The same may be said of 'journalists,' of whom 32 are set down, although probably most of the energetic thinkers and talkers have done journalistic work at some period of their career. Journalism is well represented and in the aggregate forms a powerful group, for only one of them sits on the Conservative benches. They are reinforced by 7 newspaper proprietors, although here again many members otherwise labelled are also part-owners of newspapers. Stockbrokers number 4, company directors 10, mining directors 2, and company promoter 1. Obviously these overlap the other descriptions, for a larger number of the Members of Parliament are directors of companies, and it is not too much to say that an appreciable fraction of our legislators are willing, and have been willing, to act as company promoters when a suitable opportunity is offered. Of engineers there are only 8, and not one of these is a professional mining engineer, unless we include the member for Wednesbury, who is more properly termed a contractor. But there are 13 miners' representatives, and at least 5 men who have worked as coal-miners. These are all in the Labour party. The most anomalous group, as regards "profession or occupation," is that of "heirs to peerages," of whom there are 18, with 2 who are described as "Peer's son." Farmers number only 8, but some of them come under 'country gentlemen.' A group of 13 bankers furnishes critics for the Chancellor of the Exchequer. Several authors, publishers, printers, auctioneers, architects, physicians, surgeons, school-teachers, lecturers, ship-owners, iron-masters, distillers, brewers, manufacturers, and merchants help to give variety to the

legislature. Among single representatives of useful occupations are an ironmonger, a draper, a stationer, a butcher, a tanner, a stonemason, a fish-curer, a bleacher, a pilot, and even a philanthropist. Taking it as a whole the House of Commons is a thoroughly conventional representation of the people of Great Britain and Ireland. Of course, we deem it by no means an ideal representation, for the engineering class, meaning thereby those that create and direct industrial activity, is under-represented. We would like to see more engineers—civil, mining, and mechanical—more architects, chemists, and doctors, more manufacturers and merchants, and a less marked preponderance of those whose qualification is based mainly on the ownership of inherited wealth, without any other special qualification. However, that will come. For the present we conclude that the new House of Commons is thoroughly representative of the ideas, social, industrial, and political, that dominate our country.

Waihi.

The circular issued by the secretary of the Waihi Gold Mining Company on January 27 furnishes the climax to a most unfortunate episode. To those who look upon mines as a means of making money—and that undoubtedly is the paramount purpose of mining—the episode is adequately expressed by the records of the Stock Exchange, showing that Waihi shares fell on Monday, January 31, by which time the circular had been read, marked, learned, and inwardly digested, to $3\frac{1}{2}$, as against a quotation of $10\frac{1}{8}$ in February 1910. As the company has 500,000 shares this collapse is equivalent to a depreciation of over three and a half million pounds sterling, all of which is, at present, lost. The circular contains a report on the mine by Mr. R. E. Williams, the assistant superintendent, together with an explanatory note by the secretary. The whole matter is summarized in the statement that

"sufficient work has now been done on the 9th level to show that the developments are very disappointing and that the working of the mine and mills must be based on the assumption that the 9th level is decidedly worse than the levels above." The output is to be reduced to 1000 tons per day, as against a daily production of 1400 tons a year ago, and dividends are to be reduced to 8s. per annum as compared to 18s. in the years 1909 and 1910. Vigorous development is promised, but the excessive inflow of water is mentioned as an obstacle to deeper exploration. Diamond-drilling is not suggested. Mr. Williams associates the impoverishment in the deeper workings with the fact that "a soft decomposed country rock, similar to that found near the surface" has been cut after passing through the Martha lode on the 9th level. It has been his experience in other districts that rock of this kind is "an unfavourable sign" and it is his opinion that "this development will not prove an exception to the rule." A change of rock is certainly concomitant with changes in the richness of lodes in many districts, notably the Thames, a near neighbour to the locality made famous by the Waihi mine. In the Thames district the country traversed by the gold veins consists of successive flows of andesite, varying in texture, and profoundly affecting the richness and other characteristics of the fractures now constituting the lines of valuable ore deposits. At Waihi similar conditions appear to exist, for the lodes do not extend into the rhyolite which covers the andesite enclosing the big orebodies of a complex vein system. The Grand Junction company had to sink 500 feet before reaching a productive zone. Under the favourable formation of andesite there may be another volcanic rock in which, for causes hidden to all but an experienced mining geologist, the lodes become as unproductive as they have proved to be in the cap of rhyolite. We do not make statements as to the local geology; we only suggest obvious questions.

It is too late in the day for a big and rich company to rest content with telling its shareholders that half the value of their property has been wiped out suddenly by the existence of "soft decomposed rock." What is the rock? Are the resources of science unknown in New Zealand and in London? Is the problem of so recondite a character that it must be regarded with an air of stupefaction? Assuredly not. As a parallel instance we commend to the Waihi directors a careful reading of the history of the Tonopah mines, in Nevada, more especially of the Montana-Tonopah, and of the highly successful geological diagnosis made there by Mr. J. E. Spurr. There the ore-bearing horizon is confined to particular flows of earlier andesite and dacite, ruptured by faults. We share with experienced mine foremen a contempt for the pretentious verbiage and vague generalities of the average geologist who never goes underground, but we have no sympathy whatever for the mine superintendent or the board of directors that is unwilling to profit from the researches of the geologist who has made a speciality of ore deposition. Not many such men are available, and most of them are in America, for the simple reason that in that country geology early took an economic turn, apart from coal. It does not matter how many such men are available, the Waihi company ought to have retained the best of them, instead of coming forward in the year 1911 with such a lame and tardy explanation. It is tardy. Two years ago it was known that the lodes were becoming seriously impoverished, for at that time a report to this effect was made to the Mines Department of New Zealand. We are now informed, in the circular, that the Government Geologist has made "a thorough examination of the Waihi field" and that "the directors look forward with much interest to . . . the results of this scientific petrological examination." If this is meant as anything more than an empty compliment, we venture to ask why

the directors did not have a "petrological examination" made at the company's expense and for the company's benefit. But a petrological examination alone is not enough; that will supply some facts, but not all. Moreover, the facts must be correlated and interpreted in terms of practical significance. This can only be done by a keen geologist saturated with actual experience in underground mining. We mean men like S. F. Emmons, J. F. Kemp, F. L. Ransome, J. E. Spurr, W. H. Weed, Horace V. Winchell, Malcolm MacLaren, and J. W. Gregory. A company like the Waihi could afford to engage several of them rather than flounder helplessly in the face of such a calamity as is represented by a depreciation of three and a half millions sterling. We regret the episode and its culmination. The Waihi is a mine that has been exploited and managed by men of proved capacity, lacking only courage and enterprise—the enterprise to use every weapon of science, the courage to tell the truth promptly. Even at the end, before the bombshell of the circular was thrown on the market, there was a delay that is inexcusable. The report is dated December 14; the circular was issued on January 28. The six weeks intervening afforded time enough for the gist of the report to leak out, as it apparently did, despite the perfect discretion of the members of the staff. Such information always does leak out.

Why was not an abstract of the report cabled to London and issued promptly to the shareholders? The cost of doing so, is, of course, negligible. It is well enough to claim that full information has at all times been given to the shareholders. Unfortunately these unhappy people suffer as much from an excess as from a lack of detail; what is wanted is the intention to convey the meaning of mine developments as they occur, by means of such explanations as may fairly be understood by untechnical persons. We need more information that is really informing. We quite believe

that the directors of the Wards meant to do the fair thing and that the staff on the mine were glad to cooperate in doing what was right. But they failed all the same in handling a difficult situation in any other than a blundering way. Two things were needed: frankness and science. Both are necessary to legitimate mining, especially in operations involving big sums of money.

Golden Horse-Shoe.

In our December issue we expressed our sympathy with Mr. J. W. Sutherland when Mr. Henri Kuss, the French Inspector-General of Mines, cabled his criticisms of Mr. Sutherland's estimate of the ore remaining in the famous mine at Kalgoorlie. We were quite wrong. Mr. Sutherland does not need our sympathy, for he is protected by Mr. E. Protheroe Jones. This gentleman, the secretary for the Golden Horse-Shoe Estates Company, has issued a circular coolly discounting the criticisms of the eminent French engineer and referring them back to Mr. Sutherland. Thus the Board of directors, through its secretary, cheerfully disowns the responsibility of expressing a judgment as between the disputants, contenting itself with the suggestion that they should continue the controversy. For it is obvious that the secretary and his directors, if they know anything about the mine and the system of operations, should be able to discriminate between those criticisms that are serious and those that are frivolous or unfair. With the secretary's circular the shareholders have received the report of Mr. Kuss, the French original being paralleled by an English transaction. As most of the Australian shareholders do not understand French and as only a few of the English shareholders do so, at least as regards technical language, it is inevitable that most of them will consider the French engineer's report an incoherent and incomprehensible document suggesting the flounderings of an incompetent person rather than the expres-

sion of a skilful specialist, for the excellent French of Mr. Kuss is translated into the bad English of the oversaid Mr. Jones or one of the small boys in his office. This performance is unfair to Mr. Kuss, to the shareholders, and to the public. The pamphlet containing the report covers 54 pages and it was—to say the least—a poor exhibition of economy to take so little pains to obtain a good translation, and, in the second place, to omit a section of the mine workings, so that the reader might easily follow the lucid and interesting description given by Mr. Kuss. For his report is decidedly both lucid and interesting; it is an eminently professional document, and by no means warrants the sneering description by the secretary, who says that the report "is of such length and, in large measure, of such a technical character, that it is feared by the directors that a perusal of it will not be readily appreciated by shareholders not versed in mining technicalities." People do not 'peruse' technical reports; if they want to know how the Golden Horse-Shoe mine is sampled, how the ore is estimated, and how differences of appraisal may arise, they will do well to read Mr. Kuss's report carefully, either in the original or in a fair translation by some competent person. As the report was intended mainly to enlighten Continental shareholders we can readily understand why Mr. Kuss took such pains to describe details, and we can well imagine that the gentlemen on the other side of the Channel will appreciate the sincerity of his effort. We trust that they will not be in a hurry to serve a requisition on Mr. Jones and his Board, for that would be too dreadful, having regard to recent events in connection with another company.

Coming to the points raised by the French Inspector-General, we find that he submits Mr. Sutherland's successive estimates to a searching analysis and detects the various rectifications made as the reserves have been depleted. The criticism is not malicious; on

the contrary, it will help shareholders to understand the difficulty of an appraisal, it explains the occasional discrepancies, and fulfils the purpose of Mr. Kuss's visit to the mine. These rectifications in five years reached the figure of 674,147 tons. They do not constitute a reflection on the manager so much as they afford a proof of the great difficulty of estimating ore in a lode without definition and containing gold in a form not visible to the eye. Sampling is cleaner than stoping. In order to make accurate deductions from sampling and assaying it is necessary to know what correction must be made for waste broken in the course of mining. But the next criticism is more serious. Mr. Kuss alleges, and proves, that Mr. Sutherland has been in the habit of including, in his estimated reserve, portions of ground that have been incompletely developed, that is, not 'blocked out' on three sides, but tested by one level for the full length and by another level only partly extended. Thus the results of future exploration have been discounted, and not always correctly. The point raised is of the greatest importance. The secretary's circular ignores it, but it is one to which he and his Board might have been able to reply immediately, always supposing that they understand the operations at Kalgoorlie. The records in the London office will prove whether Mr. Kuss is truthful in his assertions. If he is, and we have not the slightest reason to impugn his integrity, then his criticisms are well founded. In mines containing telluride ores it is extremely risky to include in the reserve any ground that is not 'blocked out' on three sides, at least; indeed, a cautious man will wait until it is tested on four sides, and he will see to it that the blocks are not too big, that is, he will often require the supplementary evidence afforded by an additional rise or an intermediate drift. In consequence of anticipations not based on adequate exploration and by reason of the further complications caused by faulting, the last estimate made

by Mr. Sutherland is deemed by Mr. Kuss to be erroneous. Finally, by making deductions based on the recent history of the mine and his own inspection of the workings, the French engineer makes an estimate which is smaller, by 33,875 ounces of gold, than that of Mr. Sutherland. This revised estimate the directors refuse to accept, protesting that Mr. Kuss did not himself sample the mine in detail, and therefore is not competent to criticize a man who has done so thoroughly. This may appeal to the layman; it will not deceive those who are experienced in mining. In the first place, Mr. Kuss is no fledgling, to whom full directions must be given. A man of his experience is entitled to use his own judgment and to do what is in the best interests of his clients. In his report he shows that the sampling and assaying of the mine has been thoroughly checked by actual extraction, for in the period reaching from January 1, 1903 to June 30, 1910, the tonnage treated has been 1,690,733, and in this amount of ore the underground sampling had indicated the presence of 1,285,268 ounces of gold, from which 1,159,233 oz. was extracted and 149,678 oz. is estimated to remain in residues, so that account is made for 1,308,911 oz.; in other words, the total discrepancy in 7½ years is only 2%—and on the right side. Evidently no fault is to be found with the sampling and assaying. Mr. Kuss was fully warranted in proceeding to investigate the deductions and general method of estimation based on the sampling results. If he had insisted on re-sampling the mine he would have had to retain a large staff, for he could not employ the men in the mine, a doubt having then been indicated as to their reliability. He would have had to expend four months of time and about £2000 of money completely to re-sample the workings of so large a mine, and only to test the trustworthiness of methods already proved by 7½ years of actual extraction. It seems rather small for the Board, and Mr. Sutherland, to cavil at Mr. Kuss's expres-

of their work. We consider the French expert thoroughly correct in his attitude. An engineer is recreant to his code if he squanders money in a theatrical performance or is afraid to refuse to do what he knows to be useless. On the whole we are favourably impressed by the tone of the report and regard it as a document of great technical value. We hope that the eminent French engineer will not be disgusted by the treatment to which he has been subjected but that he will remember what Monsieur Shakespeare says: "The bearer of unwelcome news hath ever a losing office."

The Rhodesian Boom.

A vast amount of twaddle is now being fed to the public through the medium of the financial Press, evidently with the purpose of exciting speculative interest in Rhodesian gold-mining shares. Every little boomster is writing to his paper to prove that the shares in which he is interested "have merits that justify much higher prices." Meanwhile the big financiers may pardonably smile and seat themselves comfortably in the background while the little farce is enacted. It is one of those farces that is played for a thousand nights and yet never loses human interest. It is the same old game.

The financial newspapers publish simultaneously a list of the dividends paid during 1910, showing a total of £860,405, as compared to £422,517 in 1909. One paper includes the Charter Trust & Agency company, which has only a slight interest in Rhodesian mines. This inaccuracy is unimportant compared to the emphasis laid on the increase of dividends without any reference to the over-discounting of this pleasant fact in the form of excessively high share quotations. When a man buys a £1 share at £5 and receives dividends at the rate of 25% on the nominal capital, he is only getting 5% on the money he has paid. It is misleading to state the per-

centage represented by the dividend unless it is made clear that the rate is based on nominal capital, the amount of which appears to be a matter of academic interest once the shares have soared to a high premium. Thus Globe & Phoenix is put down as paying 125%; this looks grand, but it is only slightly over 10% on the 5s. shares when quoted at their recent high price of £3, giving the mine a valuation of £2,400,000. The Eldorado Banket paid £90,000 in dividends; this is put down as 30%, which is true as regards the nominal capital, but it is a meagre return, of only 3¼%, on another sum of £2,400,000, which represents 300,000 shares at the recent price of £8. Giant, with a dividend of £37,552, may yield a nominal 15%, but it is an actual 2¼% on a recent market valuation of £1,500,000. Finally, if we omit the Globe & Phoenix, the seventeen other companies paid £666,655 on a market valuation of £10,200,000, which represents a return of only 6⅔% on the millions that have been paid for the shares of these mines, not to mention a larger number of enterprises that make no pretence of earning profits. Of course, some of these mines will do better, and we quite appreciate the excellent prospects that they may possess, but the 17 companies that are paying £666,655 per annum between them will have to double their dividends to begin to justify even the present share quotation, let alone the higher prices to which the boomsters hope to boost them. When flamboyant finance imposes upon ignorance, the business resulting may be called 'mining' by some people. It is not; it is 'spoofery.' Those who bought shares at par, or those who underwrote them at a discount, can afford to smile at rates of dividend expressed in terms of nominal capital, and they can rejoice when the shares are kited to a premium of 200 or 300 or 400%, but the simpleton who plays their game is a fool. The fact is the Rhodesian companies have been boomed enough; their improving prospects have been over-discounted.

SPECIAL CORRESPONDENCE

News from our own Correspondents at the principal mining centres

NEW YORK.

Business in 1910.—The year just closed was a disappointment in many ways. Despite large crops and record imports and exports, business in general failed to come up to expectations formed early in the year. In February the blast-furnaces were making pig-iron at the

The average for the five preceding years was 231,000,000. On the other hand, fundamental conditions seem to have been good. The value of farm products for the year was \$8,926,000,000, as compared with \$8,760,000,000 in 1909. The Lake Superior iron ore production increased 936,328 tons during the season of navigation,

PRODUCTION OF PRECIOUS METALS IN THE UNITED STATES.

State or Territory.	Gold		Silver	
	1909 Value.	1910. Value	1909 Fine oz.	1910 Fine oz.
Alabama	\$29,200	\$29,416	200	264
Alaska	20,339,600	16,987,990	198,600	126,480
Arizona	2,626,800	3,375,256	2,523,600	2,835,641
California	20,703,600	21,146,150	2,304,900	3,530,246
Colorado	21,846,600	20,408,641	8,846,300	8,747,777
Georgia	43,400	25,488	200	286
Idaho.....	1,344,200	992,930	6,755,900	6,686,016
Illinois			900	1,727
Michigan			217,600	268,642
Missouri	200		15,200	32,900
Montana	3,750,100	3,465,364	12,034,500	11,519,059
Nevada	16,386,200	17,941,643	10,119,200	9,346,256
New Hampshire		599	3,000	854
New Mexico.....	252,800	397,974	324,200	683,111
North Carolina....	31,400	54,884	400	1,215
Oregon	829,000	631,173	69,600	62,848
Pennsylvania	6,200	2,419		7,867
Philippine Is.	247,600	90,357	3,000	1,523
Porto Rico	600	1,013		2
Kansas		11,163		4,113
South Carolina	7,400	31,566		11
South Dakota	6,573,600	5,183,070	196,300	113,460
Tennessee	4,300	3,514	65,300	75,714
Texas.....	400	475	408,100	365,854
Utah	4,213,300	4,243,907	10,551,100	11,242,301
Virginia	4,000	558	6,400	34
Washington	429,000	711,359	75,200	176,816
Wyoming	3,900	3,990	1,800	1,363
Oklahoma		15,090		66,476
Miscellaneous		299,225		539,839
	\$99,673,400	\$96,055,214	54,721,500	56,438,695

rate of 31,000,000 tons per annum. In December the rate was 23,000,000. Railway earnings, while larger than in 1909 and generally equal to the high records of 1907, decreased with each quarter of the year. Bank clearings naturally followed, but stock-exchange business suffered most of all. Sales on the New York exchange were but 160,000,000 shares.

reading a total of 42,620,201. Pig-iron production amounted to 26,800,000 tons, as contrasted with 25,795,471 in 1909. The coal output for the year amounted to 480,000,000 short tons as contrasted with 459,715,704 in 1909, and will nearly equal the record output of 1907. Everywhere the story is the same. Industry has recovered from the depression of 1908, but

productive enterprises suffered and investors are not yet ready to take risks as to the future. The year closed amid much discouragement in the steel industry, where the advance business booked had been steadily decreasing month by month. There were rumours that prices were to be cut to stimulate demand.

Gold and Silver.—Estimates of the gold and silver production of the various States were published by George Roberts, Director of the Mint, early in January. They are of interest in that they show an increase over production in 1909 and some changes in rank among the States. California passed Colorado and regained its old place at the head of the column. South Dakota fell behind, because of labour troubles at the Homestake mine early in the year. The Alaska output decreased markedly but is expected to climb again as the dredges at Nome get into regular work. The detailed figures are given below. Gold imports for the year, by the way, were \$54,245,000 as contrasted with \$44,086,966 in 1909. The corresponding figures for exports were, 1910, \$57,444,000; 1909, \$132,880,821.

Copper.—In 1910 the attention of mining men was centred on copper to an unusual degree, and the story of the year is one of weak prices, large production, and constant struggle with the surplus. According to B. S. Butler of the U.S. Geological Survey, the output of blister and Lake copper was 1,079,000,000 lb., as against 1,092,951,624 in 1909. Figures published by the Copper Producers' Association for the first eleven months of 1910 indicate that the production of marketable copper by the regular refining plants from all sources, domestic and foreign, will amount to about 1,448,000,000 lb., as against 1,405,619,519 in 1909. According to the Bureau of Statistics, imports of pigs, bars, ingots, plates, and old copper for the first eleven months amounted to 255,237,942, and the copper content of ore, matte, and regulus imported amounted to 75,958,712 lb. If the imports for December were equal to the average, the amount of copper entering the United States for the year was about 338,000,000, as against 321,801,114 lb. in 1909. Estimates indicate that the exports of copper will exceed the exports for 1909, which amounted to 682,846,726 lb., and that they may be as much as 700,000,000. Domestic deliveries for the first eleven months of the year, as given by the Copper Producers' Association, indicate a consumption of copper in the United States exceeding that of any previous year and reaching, perhaps, 770,000,000, as compared with 688,565,243 lb. for 1909.

Arizona again takes the lead among the copper-producing States with an output slightly above the production of 1909, which was 291,110,298 lb. The Bisbee district was the largest producer, with an output of approximately 145,000,000 lb. The production of Montana probably did not exceed 285,000,000 lb. for 1910, as compared with 314,858,291 lb. for 1909. The State therefore ranks second, with Michigan third. Utah, ranking fourth, made a marked increase in production over 1909, which was 101,241,114 pounds.

Lead.—The statistics of lead production and consumption published annually by C. E. Siebenthal are of especial interest, since they are the only figures made public. In contrast with copper, where the Copper Producers' Association gives out complete figures at the end of each month, nothing is known as to lead except at the end of the year. The industry is dominated by the Guggenheims, and while there are frequent complaints, there is no apparent probability of a large independent interest being created. Through the American Smelting & Refining and affiliated companies, the Guggenheims not only control smelters and mines, but they also dominate the National Lead Co., the largest consumer. The tariff shuts out foreign producers, except for 10% of the lead smelted in bond. According to Mr. Siebenthal's figures, which are based on returns from producers and records of imports and exports kept by the Bureau of Statistics, the total production of refined lead, desilverized and soft, from domestic and foreign ores in 1910 was approximately 469,682 short tons, worth at the average New York price \$41,332,016, as compared to a production of 448,112 tons in 1909, and 396,433 tons in 1908. These figures do not include an estimated output of 13,943 tons of antimonial lead, as against 12,896 tons in 1909, and 13,629 tons in 1908. The total production of lead of domestic origin was 379,076 tons, as compared with 345,255 tons in 1909, an increase of about 10%. Of the total production, desilverized lead of domestic origin, exclusive of desilverized soft lead, is estimated at 217,166 tons, as against 194,034 tons in 1909, and desilverized lead of foreign origin comprised 90,606 tons, as compared to 102,857 tons in 1909. The range of quotations was from 4'70c. per lb. in January to 4'28 in May. The average for July was 4'41 and for August, September, and October each, 4'40. Such remarkably uniform prices were not paralleled except in the matter of steel rails. Late in December it was announced by officials of the A. S. & R. Co., that less than a

week's supply was available. There were evidently good deliveries in production. The surplus accumulated a couple of years ago has disappeared. The Cœur d'Alene district is known to have reached the turning point, British Columbia is not now competing heavily in the United States market, the Leadville output is falling, and neither Utah nor Southern Idaho have increased production as was at one time hoped. Leadership in lead production is returning to the Mississippi Valley, and in the great deposits of southeastern Missouri particularly is the largest known American lead reserve. Conditions have been good there in the year just closed and production has doubt-



A main adit in Colorado.

less increased, though at Joplin, despite activity in zinc, the lead output was slightly less than in 1909. In Idaho and Missouri lead can be produced at about the same cost, approximately 3c. per pound, the accessory silver of the one district offsetting cheaper fuel and labour in the other. In Missouri there are large unprospected areas and one of the leading companies has been so successful in drilling for ore as to feel safe in cutting down materially on exploratory work. The Missouri ore is practically non-argentiferous and evidently as smelting becomes more prominent in the Mississippi Valley the copper furnaces of the West will be relied on more to smelt gold-silver ores.

Zinc. — Frequent references have been made in these letters to the condition of the zinc industry. In brief, prices have been high and production large, but increasing costs have

borne heavily on the smelters. Mr. Siebenthal's review for the year shows that domestic production broke all records, that imports decreased 25%, and exports quadrupled. The production of primary spelter from domestic ore in 1910 is estimated at 250,052 short tons and from foreign ore at 17,371 tons, a total of 267,423 tons, worth, at the average price, \$28,881,684, as compared to a total of 255,760 tons in 1909, made up of 230,225 tons of domestic origin and 25,535 tons of foreign origin. The production of spelter from both domestic and foreign ores, apportioned according to the States in which the ores were smelted, was approximately as follows: Illinois, 73,373 tons in 1910 and 67,653 in 1909; Kansas, 105,659 tons in 1910 and 103,299 in 1909; Oklahoma, 34,762 tons in 1910 and 28,782 in 1909; all other States, 53,629 tons in 1910 and 56,026 in 1909. The total production of spelter is equivalent to the output of 61,700 average retorts operating continuously throughout the year or about 70% of the maximum capacity of the smelting plants in operation for some part of 1910.

TORONTO.

Mining Law. — The work of drafting a mining code for the Dominion has been assigned to J. M. Clark, K.C., of Toronto, a well-known authority on mining law, who has had a wide experience in mining cases involving constitutional points. The necessity for such a general law has long been recognized. In the older Provinces, which control their own mineral resources, operations are regulated by provincial laws. The Federal government has jurisdiction over the mining lands of Manitoba, Alberta, Saskatchewan, the Yukon, and the unorganized areas, as well as over the lands situated in the railway belt of British Columbia and some other lands included within provincial boundaries. Hitherto, there has been no parliamentary legislation for the regulation of mining in the areas under Federal control with the single exception of the Yukon Placer Mining Act. The Government has dealt with the situation by the issue of orders-in-council embodying such regulations as appeared necessary from time to time. This has been far from satisfactory, resulting in much uncertainty and confusion. It is now felt that, with the large interests involved owing to the rapid growth of the mining industry in the West, the time has arrived for the enactment of a definite and uniform code. The dissimilarity of the laws of the older Provinces will still remain, but it is hoped that should the provisions of

the code be found satisfactory, its leading features may be embodied in provincial legislation, subject to such modifications as may be necessary to meet local conditions.

Rainy River.—The stagnation from which the once active gold mining district of Rainy River in northwestern Ontario has suffered for many years, and from which it latterly shows signs of recovery, is a striking instance of the injury that may result from legal uncertainties. During the last decade of the past century a number of the mines were productive, but a question arose over the validity of the patents issued by the Ontario government, the claim being advanced that this region was under Dominion jurisdiction. Many years of litigation ensued in the case of the Ophir mine, the question being taken from court to court and finally decided by the Privy Council some three years ago in favour of the Province. In the meantime the uncertainty as to titles throughout the region deterred capitalists from investing and ruined the industry. It is only lately that interest has again been aroused in the district and a number of the mines including the Mikado, the Ecuador, and the Ophir re-opened. The Mikado, which is being operated by H. A. Machin and associates, is yielding ore running \$7 per ton on the 150-ft. level, and has been proved to 400 ft. with a diamond-drill, at which depth the ore shows \$18 per ton. At the Ecuador, in which Sir John Murray, of Challenger exploration fame, is largely interested, a large body of rich ore yielding 24 oz. per ton has recently been found.

Porcupine.—Good progress is being made with the branch railway to Porcupine, on which 500 men are now working. The laying of rails was recently begun. There is great activity in freighting supplies, machinery and construction material to the camp over the winter roads, several hundred teams being kept busy. Speculation is very active both in mining locations and building lots, but while many large transactions in mining property are reported, there is surprisingly little demand for the shares of such flotations as have been placed on the market, and it looks as if many of the promoters who have paid high prices for unproved properties, with the idea of raising money for development by the sale of shares, will find themselves badly disappointed. There is not likely to be anything resembling the Cobalt boom in the way of heavy gambling in mere prospects. The investing public appear disposed to wait for tangible results before taking chances. The Dome Mines has placed a contract for a 40-stamp mill to treat 250 tons per

day. A representative of the company has visited most of the important gold mines in America with a view to ascertaining the best method of treating the ore. The lode formation, apart from the quartz, has been found to carry gold and has been proved by diamond drilling to a depth of 300 ft. The Hollinger has been placed in charge of Percy E. Robbins, lately manager of the McKinley-Darragh at Cobalt, who will look after the other Timmins interests in the district. The shaft of the Hollinger is now down 175 ft., the ore at that depth equalling the surface showing. About 70 men are at work and several good finds have lately been made in the course of surface exploration. The Porcupine Exploration & Mines Co. which recently took over the Herlihy-McPharland group of claims, where some good finds have been made, has increased its holdings by taking an option on three other claims in Deloro township. The Tisdale Mining Co. has been organized with Frank C. Armstrong as president, and E. P. Earle of the Nipissing Mines Co. as vice-president, to operate the properties of the Armstrong-McGibbon syndicate, comprising 17 locations in Tisdale township.

Cobalt.—The output of this district for 1910 was 34,026 tons of ore as compared with 29,942 tons in 1909. In addition, bullion was shipped to the value of \$491,000. The returns in dividends from 11 companies, together with the estimated profit of the O'Brien, a close corporation, totalled \$8,302,000. The total dividends and estimated profits since the inception of the camp are calculated at \$25,342,355. Notwithstanding these apparently favourable figures, last year witnessed a steady depreciation of Cobalt shares, especially those of non-dividend paying mines. The market-value of the shares of 36 companies, on the Toronto stock exchanges, shows a depreciation during the year of about \$11,000,000. In the face of this condition it is hardly surprising that the public is disposed to be a little shy of mining flotations. La Rose continues to improve its position, the output shipped during December amounting to 417,000 oz. silver, of which the greater proportion came from the Lawson property. The amount of cash in the treasury and due from smelters is given at about \$990,000. The Nipissing during December mined 371,559 oz. silver. On No. 64 vein, between the third and intermediate levels, an orebody carrying 1880 oz., from 10 to 12 in. wide, has been blocked out for 55 by 40 ft. On the Meyer vein a winze is being put down from the 175-ft. level in a small streak of rich ore. The

Bailey has made a strike of two good veins on the 75-ft. level. The shareholders of the Tretthewey have ratified the proposal to increase the capital from \$1,000,000 to \$2,000,000 for the purpose of purchasing additional properties. Silver Bar is in liquidation, all attempts at a re-organization having failed. The creditors have decided to offer the property for sale. A report issued by the City of Cobalt for the last quarter of 1910 shows receipts for ore to the amount of \$51,850, and a balance on hand of \$28,525. Kerr Lake has declared a 5% dividend with a 5% extra bonus. This brings its total returns to shareholders up to \$3,030,000, or 1% over its capitalization.

cannot find that the mineral deposits so far discovered are of sufficient merit to justify the expenditure of public money in constructing the road. The orebodies, which have gold as their chief value, do not contain it in a free milling state in sufficient quantity to make stamp-milling feasible. As regards asbestos, that which was noticed in the working faces of the open-cuts as well as in the dumps was insignificant in amount and insufficient for their development as mines. There was no probability of the discovery of silver or cobalt.

Production of graphite in Canada is increasing, and the industry promises to be of some importance. The graphite flake has a



RAILWAY STATION AT COBALT, ONTARIO

Chibougamou.—The project of the construction of a railway by, or with the aid of the Quebec government to open up the Chibougamou district, lying about 300 miles north of Montreal, on account of the supposed value of its mineral resources, has received its quietus by the publication of the report of the commissioners appointed by the Quebec government to examine the district. The commissioners were Alfred Barlow of McGill University, Montreal; G. C. Gwillim, Queen's University, Kingston; and E. R. Faribault, of the Canadian Geological Survey. They report decisively against the proposal, as they

high carbon content, and is of great strength, which makes it valuable to the manufacturer of crucibles. W. H. Mathews has recently sold his properties at Wilberforce, Ontario, to the Virginia Graphite Co., which is erecting a modern dry plant with a capacity of 100 tons per day. He has acquired further claims and is actively developing them. The ore averages about 30% and is soft; after being exposed to the sun and air for a few days it can easily be disintegrated. The Dominion Graphite Co. of Buckingham, Quebec, is at present reconstructing its plant. The International Co. of Calabogie, Ontario, is working

lay and went and with success. Graphite Limited, at St. Joviete, Quebec, is installing a large plant and intends to start shipping in the spring. The Canadian Graphite Co. of Montreal, with mines at Lachute, Quebec, has a fine property and is about to erect a treatment plant. The representatives of several American companies are making examinations. Progress in Canada has hitherto been hampered by ignorance as regards concentration, but it is now hoped that the industry will go forward without check.

MELBOURNE.

Bullfinch.—The year 1910 has just ended and it is right therefore to make some retrospect of gold mining in the twelve months. Progress has been small. When the Bullfinch was first discovered it was hoped that at last some new and stimulating element had been introduced into Australian mining. But the news to hand from the district soon set that assumption at rest. There was too much Stock Exchange booming and too little work. As Richard Hamilton put it, there never was a finer litter of wild cats in all the history of Australia. Before me now is a letter from a prospector—one of the genuine men who go from tropic to frigid zone to examine mines and to test new ground. He tells me that 50 miles of country has been pegged out; prospectors are sitting watching the pegs and flies, wondering all the while whether, before the demand for lease-rents is made, some inexperienced Johnny will happen along to whom a few specimens or a narrow leader will spell the greatest of riches. The bubble was pricked through the instrumentality of Harold Greenway, a young fellow of 25 who went from Bendigo to take charge of the Great Chaffinch. Just before his arrival rich ore was reported to have been struck in a trench on the claim by a local director, Mr. Arthur. A party of pressmen went to look at the discovery. They then gave a certificate testifying to the richness of the strike, at the same time giving proof of their ability to fill the rôle of mining impressionists. This incident was telegraphed to London and no doubt Mr. Greenway's subsequent experiences were also made known there. How he declared the vein to be "a streak," how he was lost in the bush, and how his report was confirmed later by Mr. de Jersey Grut of the firm of Black, Blatchford & Grut, mining engineers, is all past history. But the investing world has not at all adequately recognized the service rendered to it by Mr.

Greenway. On the Stock Exchange of Adelaide his name is practically anathema in Arthur circles. One of the most experienced and reliable mining men of Western Australia now visiting the Eastern States tells me that he knows the arguments used to convince Mr. Greenway that he was premature in his conclusions. It was the worry and anxiety that told upon him when he missed his way in the bush and led to his collapse at a time when under ordinary circumstances he would have laughed at his experiences. The net result of the exposure of the Chaffinch has been to bring people to a sense of their folly and to reduce speculation in Bullfinch ventures to the most modest dimensions. Dealings will shrink still further when the rich ore of the parent mine gets down to an average grade, as will inevitably be the case.

Tanami.—With the Bullfinch affair thus whittled down, the year's mining discoveries have been insignificant. The most promising locality is undoubtedly Tanami, in the north-west of the Northern Territory, hundreds of miles from anywhere. The average grade of the gold ore is fair, but the lack of water, the distance from the nearest port, and the great cost of transit (£30 per ton) make mining there today profitable only to individual prospectors, who, by picking out rich patches, do well. The warden, Lionel C. Gee, has just returned hither. He admits that the district cannot be developed till better transit is provided. That means a railway at a large cost. As the best route is through West Australian territory, across the border and 70 miles into the Northern Territory, the prospect of that work being undertaken is remote. So Tanami is in the lap of the future unless some sensational discovery should allure capital to such an extent as to encourage proper development.

Bendigo.—None of the old goldfields have done more than hold their own. Bendigo looked like having to face a very bad year, when a discovery on the Sheepshead side-line enabled the pioneer company, the Central Red White & Blue, to jump on to the dividend list and pay 10s. per share in six months on shares that before then had gone a begging. Now that this mine has opened up a shoot of rich ore over 300 ft. in length with fair-grade material still in the face to the north, the people of Bendigo are providing capital to test the 10 or 12 side-lines that have been neglected while they have been delving to over 4000 ft. with questionable success on the main anticlinal axes. The lack of new discoveries and the declining

richness of the old districts, together with the exhaustion of the alluvial deep-leads and surface deposits, will be shown in the decline of the gold yield of the Commonwealth for 1910. The output of gold will be fully 100,000 oz. less than in 1909. The greatest decrease will be in Western Australia and Victoria.

Broken Hill.—The agreement between the Broken Hill companies, except the Proprietary, and the labour-unions at Broken Hill terminated at the end of 1910. So for some time past the directors of the South and North companies, the Sulphide Corporation

Amalgamated Miners' Association is divided as to whether it will forego its demand for a 44 hours working week and so is to ballot over the matter. One development is that G. D. Delprat, general manager of the Broken Hill Proprietary Co., offered to work his mine one shift at 44 hours per week if the men would agree to existing wages, but so far there does not appear to be any desire on the part of the men to come to terms with him. Anyway, a most satisfactory understanding has been reached by the Union; this is, that it will not stop work even should its members not agree to the terms offered by the companies but will



THE RUSH TO BULLFINCH

and various zinc-tailing process companies at Broken Hill, have been negotiating with the unions in the hope that they will be enabled to come to terms for a 4½ years' agreement. Some interesting issues were raised. On the one side some of the men wanted higher wages, more money for over-time but no interference with the weekly 48 hours' work. The Amalgamated Miners' Association however, representing the underground workers, were not so keen about the extra pay, but they wanted to cut the week's work down to 44 hours. To do this means practically the loss of Saturday altogether, so that the working week will really be reduced from 48 to 40 hours. The companies have conceded some increase in wages to the unions that do not want shorter hours and have entered into a 4½ years' agreement with them. But the Amal-

gamated Miners' Association is divided as to whether it will forego its demand for a 44 hours working week and so is to ballot over the matter. Most of these are German and are associated with the Lead Convention.

The Mount Lyell Mining & Railway Co. is pressing ahead with its work on the 1100 ft. level of the North Lyell mine. It is satisfactory to be able to state that recent developments have been decidedly encouraging, as the downward continuation of another of the big ore shoots worked at 850 ft. and 1000 ft. with such profit has been proved by the diamond drill. The feature of the North Lyell ore is its consistently good grade. To have ore averaging well over 5% copper down to 1100 ft. is a fact of considerable scientific

interest. A notable change has been made in the personnel of the board of the company. This is the retirement, on account of ill-health, of William Knox, one of the members of the original company and a director ever since the mine got into the hands of Melbourne investors. Mr Knox was the original secretary of the Broken Hill Proprietary and is well-known throughout Australia as a representative of the best type of mining man. So his retirement from the industry is generally regretted. His successor is E. Neale Wigg, one of the ablest directors of the Broken Hill Proprietary.

Copper mining in North Queensland is moving ahead steadily. The returns from the Mount Elliott mine near Cloncurry are most encouraging. They show a monthly profit of over £15,000 and the board can be congratulated on the result. At the same time great pleasure is expressed at the work of the general manager, W. H. Corbould, who has been rewarded by a vote of £1000. He had an unpleasant task to undertake when he had to discard the work of his predecessor and re-organize the whole plant. Results have shown the benefits accruing from his action. The only depressing fact about the property is the failure of the bottom level to come up to anticipations. The grade of the ore keeps low and although nothing is said publicly about the matter there is a whisper that the company wants sulphide ore badly to help its smelting. The Hampden mine is nearing the date when it will become a producer, but it will be some time before the allied Duchess mine can be linked to the parent claim by railway. Until then the company will not be enabled to work to the best advantage. The purchase has been made of 100,000 shares in the MacGregor Company by E. L. & C. Baillieu. This is scrip that was not applied for at the reconstruction and it certainly appears as if the firm has made a great purchase. They also bought 80,000 unissued shares in the Mount Cuthbert mine at the price of the calls paid up on the scrip. This sale was approved by three of the directors, but was opposed by Mr. Power, the other Melbourne director, and one of the original vendors of the claim. No notice of the sale of the scrip was given to the two Queensland members of the board and Mr. Power is proceeding in the Courts to get the transaction annulled. If he can do that he will have a big try to eject the three directors and to elect a new board sympathetic to his views. The circulars that are passing between

the parties contain the bluntest assertions that have probably ever been seen in such documents. These constitute a prelude to what promises to be an exceptionally bitter lawsuit in which all sorts of disclosures are promised.

JOHANNESBURG.

Randfontein Central.—The rumoured "amalgamation of amalgamations" at Randfontein, by which the Central and South properties would fall under one solid control, has been received in Johannesburg with undisguised suspicion. Not long ago we were promised the sight of a 600-stamp mill in operation on the Randfontein Central, but no official start has yet been made with even a portion of the plant. Instead of this, before the Central has had time to prove itself, a scheme is launched for the raising of over half a million sterling from the pockets of shareholders, for purposes not yet clearly defined. It must be admitted that criticisms of the scheme are at present premature, pending some explicit statement from the board. But whatever the new scheme may be, we look not the less impatiently for the completion of the old, namely, for the demonstration of mining results proving the wisdom of a 600-stamp mill on the Randfontein Central.

Engineer and Secretary.—In *The Mining Magazine* of December 1910, Dr. Jorissen makes the serious charge against me of misquoting from a report by him on the property of the Roodevand Gold Mining Co. He claims that my misquotations have done him harm in his profession. No more serious accusation could be made against the correspondent of a technical paper. Just as the reputation of Dr. Jorissen might suffer from misquotations so it must be clearly recognized that the journal has similarly something to lose, if found guilty of this carelessness or indecency. In the issue of December 1909, I criticized and ridiculed certain official statements issued by the secretary of the Roodevand company. These criticisms, which Dr. Jorissen now appears largely to support, were introduced with the following explanatory note: "J. Hoffman and Dr. Jorissen have been advising the company. It is unfortunate that their reports, if any have been written, are unavailable. The official conclusions are expressed in a manner that can scarcely win confidence. The announcement, following the words 'The Secretary states' contains some strange remarks, etc. . . ." I then proceeded to demonstrate the absurdity of some

of these remarks. Yet, a year later, in spite of this perfectly definite explanation as to the actual authority for the statement, Dr. Jorissen coolly accuses me of misquoting his report, which I expressly declared was not available, if any existed. While it is difficult to see how such a charge can be made with any semblance of sincerity, it is quite easy to understand Dr. Jorissen's discomfiture at the criticism of the official announcement made by a company that he was technically advising—with its references to the "Witwatersrand Main Reef System" and its "tentatively named Middle Reef" and its "5 dwt. (?) yield." At the same time, his corrections to that official announcement should have been made in a straightforward manner when it was

tions of the completed plant. One of these shows the west shaft with its steel headgear, and the crusher station, equipped with sorting-belts and ore-bins having a capacity of over 1000 tons. This photograph also shows the covered way constructed for the use of natives, passing from the compound to the shaft during inclement weather. The second picture is of a portion of the sand-plant, in which reinforced concrete is extensively used, and of the belt-conveyor for removing sand residue; this is carried on a steel cantilever frame.

Hammer-Drills.—When the stope-drill competition of 1907 resulted in the victory of the Gordon drill—a victory proved decisively undeserved in subsequent practice—the prospects of a small hammer-drill being introduced



WEST SHAFT OF CITY DEEP MINE.

first issued for public enlightenment or (en-livenment) and not by means of a belated letter to a technical journal, whose correspondent had the temerity to regard a Secretarial notice, standing unchallenged, as an authoritative statement of affairs.

The City Deep, which is often cited as the "show mine" of the Wernher-Beit group by virtue of its high-grade ore reserve and magnificent new plant, is now crushing and is likely to make an initial output-declaration for January. The photographs herewith show two por-

successfully in general underground practice appeared distinctly favourable, and several drills of this type were entered for the subsequent Chamber of Mines competition. They were, however, soon completely outclassed. Tom Johnson, who was underground manager of the trials for the latter portion of the runs, was unfortunately appointed after their withdrawal or his views on their defects would have been more minutely instructive. However, in the official report on the tests now published, he supports the view that their com-

parative feature was principally due to the steels sticking in the holes, to inconvenience with water, and to the steels breaking at the shanks. It must be noted, however, that small hammer-drills have made a great advance on the Rand in certain other classes of work, notably in rising with Waugh drills. As in all dry-hole work, dust is the great objection, but if the Aymard dust-catcher is successful, it may be said that an important item of underground efficiency has been placed on a much higher level of efficiency. Small hammer-drills are rarely used on the Rand; the pop-holing is commonly relegated to hammer-boys, this work being excellent training for green Kaffirs, who can thus always be made to do useful service, whereas their inability to drill a long hole in the stope-face may lose a good bench.

Roodepoort Amalgamation.—The official announcement of the amalgamation of the Princess Estate, Roodepoort Central Deep, and West Roodepoort Deep, has occasioned little interest in local circles, the days of anxious speculation as to the destiny of adjacent properties having passed. Amalgamation is now regarded as merely a normal phase in the lives of independent companies, springing up under the motto 'Unity is strength' at the moment when one member of a geographical group requires a stimulant. Of the three mines mentioned above, it may be said that the Princess Estate is one that has (considering its difficulties) been doing well, the Roodepoort Central Deep doing badly, and the West Roodepoort Deep not doing at all. The inclusion of this latter area in an active organization is highly satisfactory, as it will carry operations still farther toward the edge of the Witpoortje break, across which lies the luckless Grey's Mynpacht and French Rand. There only remains the Saxon Mines, beyond the West Roodepoort Deep, as the last bent and broken link in the Roodepoort chain. The inclusion of this mine is a possibility to be discussed in another decade. It certainly is not wanted yet.

An Underground Office.—With bold originality, the *South African Mining Journal* puts forward a scheme for the establishment of a new department, or what may be fitly termed a sub-department, in Rand mining administration. The scheme outlined involves the appointment of a business manager, not only to devote himself to underground economics but to work underground also. The plea made contains many points of merit, but it is carried to an unworkable extreme. It is claimed that "much time would be saved if a thoroughly efficient business man established

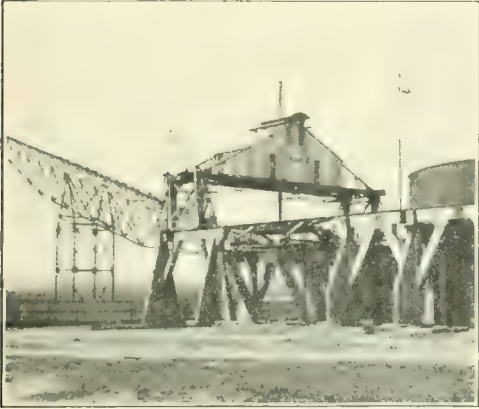
himself underground and took charge of an underground stores and accountancy department. It would not be a difficult matter to establish and equip an underground office in some central portion of the workings and from this office the mine accounting work might be more efficiently directed. All stores, such as nuts, bolts, spanners, candles—everything used in a mine in fact with the exception of explosives—might be accumulated there and drawn on at convenience without having recourse to the often inconvenient and expensive method of sending up to the surface for them and then bringing such stores down a busily worked shaft."

While the idea is overdone—the advantages being exaggerated and the drawbacks missed—it turns one's thoughts to possibly advisable transfer of more work from surface to underground. During the last few years drill-sharpening underground has grown rapidly in favour and also the introduction of drill-fitters' shops. These are not centralized but placed on many levels, so that the advantages are lost. Drill-sharpening underground is, in itself, less efficient than on surface, and wages are about 12% higher. The suggestion of establishing underground a business manager and accounting department, only irritated by the incongruous conditions, is supported by so few arguments that it calls for little remark. It is the practical mining man who can alone tell whether stores are being economically used under the varying conditions of work. The benefit of maintaining some stores underground would be very real in many cases, notably where there is two-stage hoisting. But where it would be in any case necessary to transfer stores from the central position to many other levels, the gain, as opposed to the distribution from surface, would be too small upon the "emergency requirements" to warrant the innovation on a large scale. All contractors and shift-bosses are necessarily on surface before going on shift and some of them at 'crib-time,' but it would generally be a matter of serious inconvenience for them to put in an appearance at some midway point underground, before reaching their scattered working places.

Lucky Thirteen.—The New Rand, Ltd., is still busily drilling for the southern rim of the Rand basin. The *South African Mining Journal* reports that "No. 13 borehole has reached a depth of 1657 ft., and is in very promising looking quartzites with black, blue-white (pebbles?) and pyrites." It is surprising that no dividend has been declared on this

result; perhaps it is because the shade of blue-white revealed cannot be definitely correlated with the tints of the hanging-wall country rock of the Ferreira or Robinson.

Geological Tumult.—In the geological, or more strictly, in 'stratigraphical' circles,



Conveyor-belt on Cantilever Frame, for disposal of Residue

there is proceeding at the present time a spasm of civil warfare of a most virulent type. Commencing with such minor weapons as speckled quartzites and personal abuse, the antagonists have proceeded to the most venerated systems of Transvaal geology, which are being cast about with a ruthlessness that must be most disconcerting to the Survey and its methodical officers. The trouble was started by W. Bleloch, who published a revolutionary map and treatise indicating amongst other trivial circumstances that the New Kleinfontein, Van Ryn, New Modderfontein, Brakpan, Geduld, Modder B, and other well established mines of the Far East Rand, are on a 'reef' series underlying the Main Reef. To traverse this question with fair thoroughness would demand many pages of this Magazine and more than the subject is worth until more definite evidence of the "true" position of the Main Reef has been provided. By Main Reef I mean, geologically, a series of conglomerate beds at the horizon of the famous gold-carriers represented at Johannesburg and, industrially, the beds con-

taining gold in more uniform and valuable quantities than any of the other many 'banket' beds of the system. Proof of either characteristic feature will satisfy a community of miners, but one at least is sought. Mr. Bleloch was speedily opposed by pioneer Draper, with Laurie Hamilton active in the flanks. From the standpoint of scientific decency, the sorrowful feature of the hostilities has not been in the controversies of these experienced men but has been the noisy yapping of pretentious ignoramuses, who seek to profit by the confusion and gain credit from a bewildered public, who are unable to discriminate between the spoils of honest battle and the plunderings of deserted camps. We may indeed be truly thankful that the Geological Survey is now upon the Rand and that in course of time a map will be compiled to set at rest this pandemonium in our geological home.

Transvaal Consolidated Lands, an Eckstein company of divers and scattered holdings, has floated a subsidiary company to work its gold farm Rietfontein 1228, in the Lydenburg district, with a nominal capital of £40,000.



*The Sheba Mine, at Barberton.
Howard Hill, the manager, in foreground.*

Working capital of £10,000 is provided. Development results to date are said to average 12 dwt. over 20 inches for 1400 feet sampled. The quartz veins in the Lydenburg district (dolomite formation overlaid by shale of the Pretoria series) are generally narrow and, what is of great economic importance, are capable

or being mined for small widths. Some of the stopes in the mines of the Transvaal Gold Mining Estates at Pilgrim's Rest average two feet, putting the boasted South Reef stopes of the Roodepoort district to shame. The Reitfontein valuation of 240 in.-dwt. is therefore quite promising in a region now destined (with new railway facilities) to show admirably low working costs.

Valuation of Rand Claims.—The discussion of the fathomage system continues, largely owing, it would appear, to the necessarily belated criticisms received by *The Mining Magazine* from distant and scattered contributors. A new point has been raised, in reply to a criticism of the proposal, in the following: "Since the Government Mining Engineer makes no objection to life estimates based on remaining claim-area, it is difficult to understand why he should object to the same statement based on fathoms . . . upon what basis was the agreement between the Government and the Meyer & Charlton or that with the Lark Syndicate worked out, if not upon relative claim-area?" The difficulty would soon be apparent to anyone attempting to satisfy the Government's needs with a statement expressed in fathoms on plane of reef. In determining life, three points call for consideration: intact reef-bearing area, in claims or other units, probably 'payable' mill-tonnage per claim, and estimated capacity of existing or extended plant in tons. Without this estimate of full crushing capacity of plant, no reckoning of life obviously can be made. And even the boldest and blindest supporter of the fathomage scheme has at present fought shy of expressing his stamp-mill and tube-mill capacity in fathoms. Rand metallurgical men have too great a weakness for precision. As for the valuation of ground on relative claim-areas, where it is impossible to make distinctions as to dip, ore-widths, and values, it is clearly needless to introduce these common factors into calculations for the mere sake of cancelling them again. Ratios would be unaffected. But where distinctive estimates of lode conditions can be made and where the time-factor (readiness and duration of production) can be taken into account, the ton remains the rational unit for general use.

Unpayable Ore Reserves.—In the list of spurious terms and loose phrases fated to be eliminated from the technical vocabulary, there are two that promise to "die so hard" as to outlive their utility, namely, 'reef' and 'unpayable ore.' The Rand has employed these words so freely and persistently that

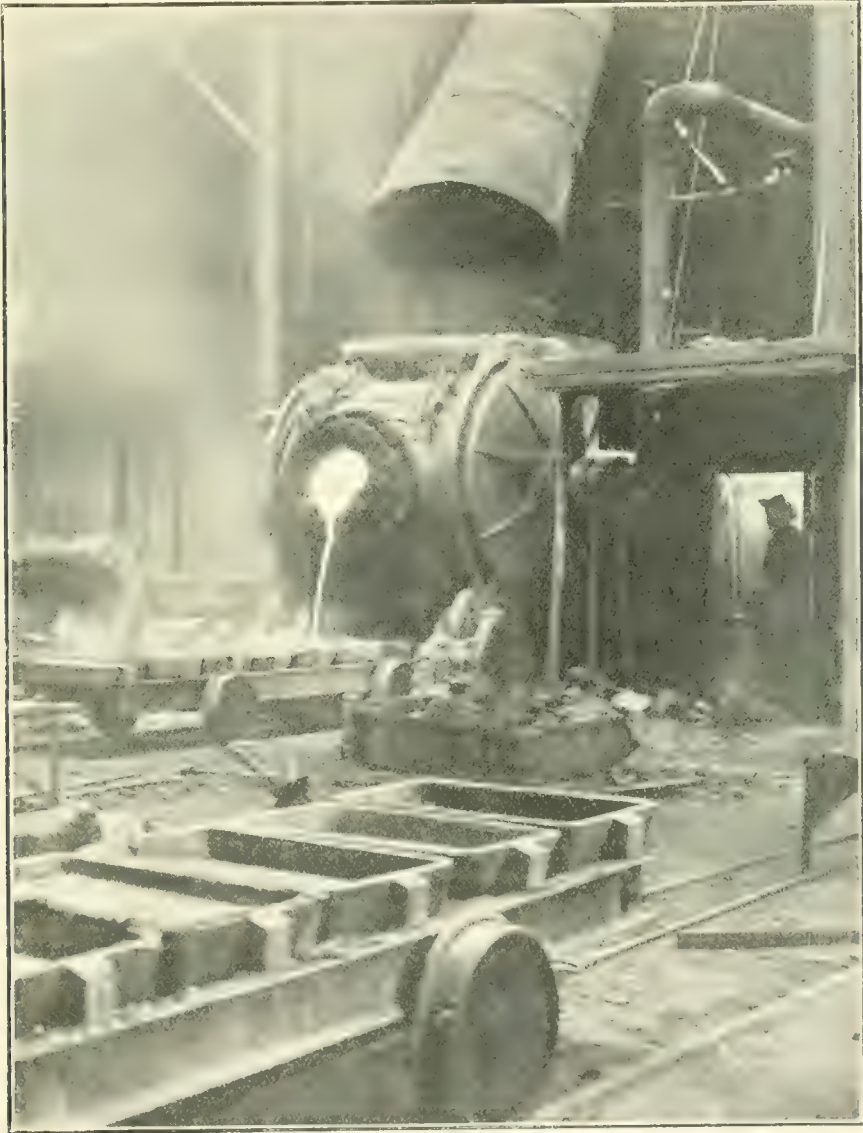
anything in the way of derision comes to be taken almost as a personal insult. There is no attempt to shelve responsibility for their development, and the natural instinct is to support other lands flatteringly with serious imitation. In *The Mining Magazine* of October, the Fanti Mines are called to task for publishing the tonnage of "payable" and "unpayable" ore. The criticism is offered that: "If the so-called non-payable ore is never to be profitable, it is absurd to state the tonnage as it would be to give the estimated weight of a neighbouring hill." Not being able to defend our West African cousins on etymological grounds, it may be argued that at all events the meaning of the statement made was reasonable, in its application to blanket conditions. In Rand and West African mines, it is unnecessary to regard payability as an essential condition of 'ore.' Development is undertaken to open up a well defined bed of conglomerate traversing a well defined claim-area. The relationship between tonnage of the particular rock that is profitable and unprofitable is of vital concern to shareholders. The bare statement that "development has exposed 200,000 tons of profitable ore" expresses only half the truth, if 1,000,000 tons of unprofitable ore has been simultaneously developed. Of course, this unprofitable ore is given as a tonnage, based on a stoping-width although the ground will not be stoped, a procedure suggestive of Irish principles if it were not for the fact that the stoping-width can be calculated for 1 dwt. 'reef' on the same basis as for 10 dwt., with proper relationship for comparative purposes.

VANCOUVER.

Production for 1910.—For the first time the Provincial Bureau of Mines has issued at the close of the year an estimate of production from figures so far available. This gives the value for 1910 as \$26,183,505, or \$300,945 over 1907, hitherto the record year. Damage done by midsummer forest fires to the Kaslo & Slocan railway and to the plant of the Granby Consolidated Mining & Smelting Co. was responsible for the fact that the output was not larger. Coal heads the list with a valuation of \$11,084,000, being an increase of \$3,500,000 over the previous year, and showing an increase of 84% within the past five years. Crow's Nest Pass mines account for more than half, and Vancouver Island mines for a third, of the increase. Metal mining shows a shortage of \$1,068,936 as compared with the previous year; and of \$4,645,342 as compared with

1907. The falling off was principally in copper, the production for 1910 being estimated at 39,000,000 lb. as against 45,597,245 for 1909, and 47,274,614 lb. for 1908, the best year. In common with others the copper companies

estimated at 2,500,000 oz., worth \$1,282,500, as compared with 2,532,742 oz., valued at \$1,239,270, for 1909. Gold, however, shows an increase of \$279,415, both placer and lode mining being better.



POURING BLISTER COPPER FROM A CONVERTER AT THE GRANBY SMELTER.

here did not push production in view of the low prices prevailing. Lead production fell to 37,000,000 lb. as compared with 44,396,346 lb. for 1909. Zinc shows an estimated decline from a value of \$400,000 in 1909 to \$184,000 for 1910. The output of silver for 1910 is

Outlook for 1911.—Coal promises to maintain its ratio of increase as three new mines are to be opened up on Vancouver Island; the Nicola Coal & Coke Co. is erecting a larger plant; and three new mines have been developed in the Similkameen and are

being provided with railway transport. Two developed gold mines at Sheep Creek are being equipped with mills; two hydraulic properties in Cariboo will have completed their extensive water-supply systems. The Granby Consolidated and B. C. Copper companies have entered on definite policies of production to full capacity; the Ikeda, on Queen Charlotte Island and, the Hidden Creek mine, at Observatory inlet, recently bonded by the Granby Consolidated; the Britannia at Howe Sound, which has been undergoing extensive development; the Cornell, recently taken over by the Tye Copper Co., besides several smaller properties, will be added to the copper producers. Silver-lead mining has an improved outlook, as the Consolidated Mining & Smelting Co. has acquired the North Star, Sullivan, Molly Gibson, and other silver-lead properties, and is equipping them for active production; the Rambler-Cariboo has recovered from the damage by the forest fires and is again shipping, with a large amount of ore assured; the Standard has now developed a big shoot of ore and is ready to become an important producer; the Blue Bell will be re-opened by the re-organized New Canadian Metal Co.; and the Van Roi, Hewitt-Lorna Doone, No. 7, and others are getting in good shape to become important shippers.

Dividend Payers.—Five British Columbia mines figured as dividend payers for 1910. These were the Hedley Gold Mining Co., with four quarterly dividends and a bonus, making 14% in all; Le Roi No. 2, with three dividends of 2s. per share, equivalent to 6%; Crow's Nest Pass Coal Co., two dividends of 1%; Granby Consolidated, one dividend of 1%; Hastings Exploration Syndicate 6d. per share, equal to 2%.

Oil as Fuel for Smelters.—The Dominion Smelting Co. is experimenting with oil for smelting purposes at the old Van Anda smelter on Texada island. Thomas Kiddie, formerly of the Van Anda, Tye, and Northport smelters is acting as metallurgist in charge of the work and reports favourable results.

Standard Mine.—Development of this property has been proceeding for several years, with shipments of ore nearly sufficient to cover operating expenses. Now this work has been rewarded by uncovering a shoot of silver-lead ore which is from 12 to 28 ft. wide, consisting of solid galena averaging 51 oz. silver and 38% lead. The length of the ore-shoot is not known as yet but No. 5 adit has been driven on it over 170 ft., and is still in ore. P. Clark, of Spokane, has taken an option on a 65% interest

from the owners, Messrs. Finch, of Spokane, and Geo. Aylard, of New Denver. The amount is stated to be on a basis of \$2,500,000 for the entire property, but the actual figure is probably considerably less. At all events development will now be pushed energetically and the property placed on the active shipping list. It is situated near Silverton, on Lake Slocan.

SAN FRANCISCO.

Petroleum.—As was anticipated, California ranked first among the States in production of petroleum in 1910. Preliminary figures, collected by D. T. Day of the Geological Survey, indicate the following output for that year in barrels of 42 gallons:

California	73,000,000
Mid-Continent and Rocky Mountain region	53,000,000
Illinois	32,000,000
Appalachian and Lima-Indiana region	32,000,000
Gulf Coast	14,000,000

204,000,000

The most striking fact brought out by these figures in comparison with those for previous years is the enormous and rapid growth of the petroleum industry of the United States. In 1859 production began in Pennsylvania with 2000 barrels and up to 1907 the Appalachian States, collectively, maintained their lead. In that year Oklahoma ranked first with 43,500,000 bbl. and Illinois became an important producer with 24,000,000. Now Illinois yields as much oil as all the other Eastern States combined, and Oklahoma is surpassed by California. The total yearly production of the United States increased gradually to slightly over a hundred million barrels in 1905 and now has doubled in six years. In California petroleum production is more important than elsewhere not only from the fact that it is larger but because absence of other fuel gives the oil output large industrial importance. It is leading to large readjustments in manufacturing conditions and the use of oil is rapidly extending. Incidentally petroleum is already used as fuel in the reverberatories at Cananea and experiments looking to its introduction at Ely, Nevada, are being made. The year was marked in California by the discovery of large gas-wells and many 'gushers' among the oil-wells. The Standard well in the Buena Vista hills flowed 15,000,000 cu. ft. of gas per day, while one of the two large wells of the Honolulu Oil Co. flowed, as nearly as could be measured, 40,000,000 cu. ft. There being no market for the gas, it was shut off by pumping in mud, after which drilling was continued to lower

horizons for oil. It is hoped that the gas may be piped to San Francisco or Los Angeles within the current year. In 1910 many large oil-wells were brought in. A list compiled by Mr. Day includes 20 that began to flow with 5000 bbl. per day or more. In a few cases, such as Mays well, Midway-Premier, and Union, the initial production amounted to 30,000 bbl. per day. The Lake View, which came in March 15 with 10,000 bbl., increased to 40,000 on July 20 and at the end of the year was flowing about 10,000 bbl., of which 56% was water. The total output of this well up to January 1 has been estimated at 8,000,000 barrels.

Goldfield Consolidated. — The annual meeting of the stockholders of the Goldfield Con. M. Co. was held at Evanston, Wyoming, on January 9. The reports presented at that meeting were for the fiscal year ending October 31, 1910, but later figures are available through the monthly statements that are now given to the Press. For the fiscal year the total production was 266,867 tons with an average value of \$40'72 per ton, equal to \$10,866,752 gross. The metallurgical loss is figured at \$2'22 per ton so that the recovery amounted to \$38'50 per ton or \$10,273,934. The total cost including mining, milling, transport, re-building of mill, taxation, and general expense, was \$2,926,242, leaving a net operating profit of \$7,347,691. Four regular dividends of 30c. per share were paid, and an equal number of 'extra' dividends of 20c., the total disbursements amounting to \$7,118,271. The company maintains a distinction between regular dividends, based on the average grade of ore, and extra dividends, due to sale of unusually rich ore. It is not expected that the latter will continue indefinitely. A cash balance of \$1,549,134 was carried forward with outstanding bullion, and by-product settlements figured at \$494,044 additional. Total disbursements to stockholders up to January 1, 1911, have amounted to \$12,800,000, which, in view of the short history of the property, sufficiently indicates its high grade. Detailed mining costs were presented by J. R. Finlay, general manager, and in commenting on them he says: "Remembering the well-known fact that the orebodies are irregular in size, shape, and grade, and that the ore is valuable enough to warrant careful handling, the management has never strained after low mining costs. Special effort is made to mine the ore cleanly, that is, to minimize the mixing of waste with the ore. Since much barren vein matter looks exactly like the ore, it is possible to prevent

mixing only by incessant sampling and assaying. Of course, any waste that goes into the ore is mined and milled at a dead loss, whether the resulting mixture is still of a pay grade or not. It will be observed that one foot of development work was done for every $6\frac{1}{8}$ tons mined. This compared with one foot for a trifle over 7 tons mined during the year 1909. Estimates of ore in sight have been made quarterly during the year, but these estimates are at best inaccurate and unsatisfactory, for the following reasons: (1) estimates of tonnage



have been found to vary between wide limits, according to the methods used in making the estimates, and according to the engineer's conception of what is 'ore in sight.' It should be remembered in this connection that it is impossible in the normal conduct of mining to expose any large percentage of the ore on more than two sides; much of it is exposed only on one side. (2) It is useless to fix a tonnage without also fixing a value for the reserves. This is exceedingly difficult, and must necessarily be somewhat in the nature of guess-work, on account of the presence of some extraordinarily high-grade ore in the midst of large bodies of average ore. One shipment of 150 tons averaged \$1400 per ton. One ton of 50-oz. ore is equal in value to 50 tons of 1-oz. ore, and a mistake of 1000 tons of 50-oz. ore is equal to a mistake of 50,000 tons of 1-oz. ore.

In the Consolidated mine the high-grade ore is far more erratic than the average ore, and there is enough of it to make quite possible a mistake of several thousand tons in estimating it. At the end of the fiscal year 1909, a very high-grade orebody had just been exposed in the Clermont shaft. After developments had proceeded on this ore for several months, it was decided by the company that it would be the most profitable policy to extract this high-grade ore as rapidly as good mining would permit so as to let the shareholders have their profits at once rather than to spread them out over a longer period. This policy was announced in February. It was not the intention of the company to convey the impression that the grade of ore maintained under this decision was the average grade of the mine. The extra 20 c. dividend per quarter was in each case declared as an extra. Five of these extra dividends have been declared, amounting in all to one dollar per share. While these extraordinary profits have thus far exceeded expectations, and may still do so, it is not reasonable to expect them to continue indefinitely. There is reason to believe that the mine can produce from the ore now exposed a tonnage equal to about twice that of the year just closed. This does not measure the possibilities, for the prospect for further development is good, and there is as yet no logical ground for fixing any term as the probable life of the mine."

Since the annual meeting it has been announced that Mr. Finlay has resigned, and J. H. Mackenzie, consulting engineer for the company, is in charge pending the selection of Mr. Finlay's successor. The reason for the change is understood to lie in minor personal differences rather than anything relating to policy or methods.

Colorado's metal production for 1910 is figured by the State Board of Immigration as follows:—

Gold	\$20,311,944
Silver.....	4,590,244
Lead.....	3,365,989
Zinc.....	3,376,890
Copper.....	1,062,051
Tungsten.....	736,800

Total.....\$33,433,918

The year was notable for (1) the completion of two great drainage adits, the Roosevelt at Cripple Creek and the Argo in Clear Creek and Gilpin counties; (2) improvement in milling low-grade ores at Cripple Creek, led by the Stratton's Independence and Portland companies; (3) further gain of the mills on the

smelters as high-grade ore becomes scarcer; (4) increased production of zinc ore and discovery of large and hitherto unsuspected deposits of calamine at Leadville; (5) growing importance of the tungsten industry in Boulder county. There has been a general discussion of the decline in mining in Colorado, but as the matter is summed up by Theo. F. Van Wagenen in the *Mining and Scientific Press* of January 7, the situation is evidently far from discouraging. On all hands it is expected that 1911 will prove better than did 1910.

MEXICO.

Mineral Production.—Definite figures on the production of gold, silver, copper, lead, and zinc in the fiscal year 1909-'10 are given by the Finance Department of Mexico in connection with the budget statement for the new year. They are stated, in pesos, as follows: Gold, 48,428,841; silver, 76,405,754; copper, 26,172,214; lead, 6,808,465; zinc, 1,150,558. In addition to the gold exported in the fiscal year under review, gold to the value of 5,668,296 pesos was purchased by the Exchange and Currency Commission for coinage. The gold used in arts and trades is estimated at 133,333 pesos. Practically all the silver produced was exported, bullion to the value of only 107,603 pesos having been purchased for coinage, while the domestic consumption in arts and trades amounted in value to but 33,870 pesos. The Department also gives figures on gold and silver for the first quarter of the present fiscal year, showing the gold production to have been 12,388,151, and the silver production 19,023,570 pesos. Compared with the corresponding period of the preceding fiscal year, there was an increase in gold production of 1,969,545 pesos, and in silver of 52,020 pesos.

Real del Monte.—Last year's development work of the Campaña Minera Real del Monte y Pachuca, the Mexican subsidiary of the U. S. Smelting, Refining & Mining Co., of Boston, resulted in greatly increasing the ore reserves. At the opening of 1911 they were fully ten times greater than at the beginning of 1910. As soon as the work of installing additional equipment in the Guerrero mill is completed, the company will be able to treat 1350 tons of ore daily. The capacity of the Loreto plant has been increased from 400 to 700 tons per day, and the enlarged Guerrero plant will handle 650 in place of 350 tons daily. The Loreto plant has been completely remodelled in design in order to bring it up to the latest standard, and in operation the Guerrero plant will be almost identical. At the

Loreto mill a large gyratory plant, with automatic conveying, sampling, and weighing equipment, has replaced the old jaw-breaker plant, with car-distribution. The new stamps weigh 1450 lb. each, and crush to 3-mesh. Stage-crushing in tube-mills is employed, with concentration of only a small selective portion of the pulp, instead of the elaborate concentration formerly in vogue. The number of tube-mills has been increased from 4 to 13, and Pachuca tanks have replaced the agitation and decantation vats formerly used. A steel tramway with a capacity of 400 tons in 10 hours is being installed between the Barron mine and the Loreto mill, a distance of 4.4 kilometres. The Girault adit, 1.8 km. long, has been equipped with electric traction. At Real del Monte all the mines now operated, with the exception of the Cabrera and Escobar, have been connected on the 400 m. level, and the San Ignacio shaft has been reconstructed to handle all ore. Big earnings are expected during the current year.

Zinc Smelting.—Renewed interest is being manifested in this subject, owing to the fact that it is now possible to obtain natural gas for fuel. A gas-field has been opened at Reiser, Texas, and arrangements have been made for the piping of gas across the Rio Grande to Nuevo Laredo. As a result, the establishment of a zinc smelter at or near that Mexican gateway is proposed, and it is not improbable that the next few months will see developments of interest to the zinc miners of Mexico. United States statistics show that Mexico's exports of zinc ore to the United States in 1910 amounted to 80,309 tons, as against 106,425 tons exported in the preceding year. Some of the Mexican zinc was smelted in bond, the spelter being exported.

Another Gusher.—Early in January the Pearson company 'brought in' a great oil-gusher in the Potrero del Llano field, in the State of Veracruz. The flow since that time has been estimated at over 100,000 bbl. daily, and the surrounding country has been flooded with oil. Late in the month it appeared that strenuous efforts to control the gusher would be successful. The flow of the new well is much greater than that of the Dos Bocas gusher, which was brought in by the Pearsons in the Tuxpan district of Veracruz, and which broke all records before burning out. About 50 kilometres divide the Dos Bocas and the monster gusher of the Potrero del Llano field. The Pearson interests have been engaged in exploration work in this oilfield for about two years and previously 'brought in' two wells

there. It is stated that in drilling the wells a stratum of rock from 200 to 300 ft. thick was pierced. Earth dams have been built in an effort to save some of the oil escaping from the gusher, and plans for pipe-lines and storage facilities are being rushed.

Seguranza.—Arrangements have been made for the transfer of the properties of the Seguranza Mining Co., in the Zacualpan district of the State of Mexico, to Americans, reported to be the Guggenheims. The price is 1,960,000 pesos, the stockholders receiving 28 pesos per share for their 70,000 shares, of a par value 10 pesos. The deal will be closed as soon as the necessary papers can be prepared. The Seguranza Mining Co. was organized several years ago to take over the old



Palmilla Co.

Coronas mines in the Zacualpan district, and it has equipped the properties with a 100-ton concentrating and cyaniding plant. Electric power for operations is furnished by the Sultepec Light & Power Co.

Parral.—The new 300-ton plant of the Alvarado Mining & Milling Co., in the Parral district of Chihuahua, is in successful operation. The 300-ton plant of the Veta Colorado Mining and Smelting Co., also in the Parral district, started a few years ago and remodelled last year, will be soon completed. Custom work will be done at both plants, and the Veta Colorado has already purchased some ore. The output of the Palmilla mine of the Alvarado company is delivered over a surface track to an aerial tramway, the latter delivering to the ore-bins at the mill. A short time ago the Alvarado Consolidated Mines Co., organized to acquire the Palmilla mine, and the Palmilla Mining Co., formed to build and operate the reduction plant, were merged in the present company.

METAL MARKETS

COPPER.

Average prices of cash standard copper :

January 1911.	December 1910.	January 1910.
£ 88. 13s. 4d.	£ 86. 18s. 4d.	£ 61. 0s. 11d.

The opening month of the New Year has belied all forecasts and prices instead of improving have declined. Two leading causes have contributed to this result: (1) The increase of nearly 2000 tons in the December production of refined copper in America, after the much advertised promises of curtailment, and the enormous shipments to Europe which must go to swell the stocks, were viewed with disfavour by the trade and with disappointment by the bulls. The latter realized freely and the pressure was increased by bear selling. (2) The establishment at Berlin of a European agency by one of the leading American producers and their efforts to gain a direct footing with continental consumers has produced a "sort of a war" between the Amalgamated and Guggenheim groups and a serious disturbance of prices. A fall in price seems particularly unnecessary just now when European trade leaves nothing to be desired and when a general improvement seems to have started in America. The market has been attacked on two sides, in standard and in refined. While heavy sales are reported on the Continent, English consumers have for the most part held aloof. The most hopeful feature is the large sales reported from America for February delivery after long abstention by buyers. The prices paid are above the parity of the large sales made in Europe. Producers, being thus substantially relieved, have again raised their prices.

TIN.

Average prices of cash tin :

January 1911.	December 1910.	January 1910.
£ 187. 17s. 11d.	£ 173. 17s. 3d.	£ 148. 3s. 6d.

The usual 'alarums and excursions' in this market have prevailed with even more than their usual vigour, and amid intense excitement the price has been pushed up to £200. The dealing is so wild that it is useless and even impossible to give an account of fluctuations. The speculative interest in the metal market seems to be centred round tin, and the account open is enormous and possibly dangerous. Naturally at this price a good deal of bear speculation has also arisen, and to protect their positions option dealing has be-

come a favourite operation. The bull syndicate seems, however, to be in full control, and they are certainly assisted by the buoyant condition of the tinplate industry. Should they wish to put prices up still higher they certainly have the power. Enormous dealings are recorded at every session. America has been a free buyer during the whole of the month and their consumptive requirements remain very large. Orders for tinplates have been booked up to the end of the year. The falling off in the Straits production cannot apparently be counterbalanced for some time.

LEAD.

Average prices of soft pig lead :

January 1911.	December 1910.	January 1910.
£ 13. 0s. 8d.	£ 13. 3s. 10d.	£ 13. 13s. 11d.

Lead has been uninteresting and the volume of purchases has been smaller than for a long time past. Consumers have been frightened by the large arrivals in London, being unaware that a great deal of the Australian shipments are in transit to continental ports. The continental trade has on the other hand been good and is absorbing a heavy tonnage.

SPELTER.

Average prices of good ordinary brands :

January 1911.	December 1910.	January 1910.
£ 23. 16s. 9d.	£ 23. 17s. 8d.	£ 23. 4s. 3d.

Little has been done in this market and business in galvanized iron is still restricted. Owing to the decreased demand the syndicate decided to reduce prices 15s. per ton. The position however is by no means bad. Stocks in producers' hands, owing to enormous sales during the past few months, are low, current output is well sold, and the trade in galvanized iron is likely to revive soon.

OTHER METALS AND MINERALS.

Prices quoted on February 11 :

SILVER.—24 $\frac{3}{4}$ d. per oz.

PLATINUM.—160s. per oz.

BISMUTH.—7s. 6d. per lb.

ALUMINIUM.—£70 per ton.

NICKEL.—£170 per ton.

COBALT.—9s. 9d. per lb.

ANTIMONY.—£29 per ton.

QUICKSILVER.—£8 per flask of 75 lb.

MANGANESE ORE.—8d. to 9 $\frac{1}{2}$ d. per unit (1%).

IRON ORE.—Cumberland hematite 20s. per ton at mine. Spanish 22s. delivered in England.

PIG IRON.—Cleveland 49s. 3d. per ton. Hematite 66s. per ton.

WOLFRAM ORE.—35s. 6d. per unit (1%).

DISCUSSION

Our readers are invited to criticise anything appearing in this magazine and to discuss other subjects of general technical interest.

Untechnical Writing.

The Editor :

SIR—Your editorial on this subject in the November issue of your valuable magazine is very necessary as a reminder to writers of technical papers, and to their editors, that the same care should be taken in the selection of language as in the preparation of data for the article.

But in technical, as in literary, efforts purely clerical errata are invariably laid at the door of the printer, and the printer's devil; and to these personages may be ascribed such faults as the offending *s* in garnets—the one plural in a list of singular substantives; and the use of the plural 'strata' in place of its singular form as originally written.

In defence of the plurals "talcose schists" and "quartzites" to which my critic objects, I must admit to using them advisedly to describe "several varieties of talcose schist" and "many kinds of quartzites" (the latter for instance in some parts of the mine being soft and laminated and in others, hard and massive); and this notwithstanding the incredulity of my critic.

For the phrase "dip of 20° from the horizontal," I may plead the honourable example of my critic himself, or his editor, q.v. page 379, 2nd column, line 22. Whose example were it better to follow than that of an ardent campaigner in favour of precision in technical writing?

"The example of pretentious ineptitude" quoted is itself clearly given as an extract from the writings of that eminent mineralogist Dr. Eugene Hussak. May I ask when it became a fashion among *litteraires* to correct the quoted remarks, or the accredited translations, of authorities?

For adopting the local words *guia* and *canga* I may adduce philological grounds. In days remote when a conquering people imposed its language on a vanquished race, it was yet forced to add to its vernacular the local names for such customs, ideas, and physical features as had so far not come into their own experience. Similarly, in endeavouring to explain what are characteristically local phenomena I claim the necessity of using the local names after purposely and carefully defining them.

In conclusion, may I be permitted to state my regret that such able criticism should limit itself to the mere clothing of the subject, when

the subject itself offers such points of interest as the unique character of the gold-bearing deposit or the low cost (elsewhere unattained) of cyanide treatment of tailing.

ARTHUR J. BENSUSAN.

Passagem, Brazil.

December 24, 1910.

[We take pleasure in publishing this courteous reply to our criticisms and willingly forego the opportunity to retort, only desiring to add that the use of "dip of 20° from the horizontal" on page 379 appears in an abstract, partly verbatim, from Mr. Bensusan's paper, given in our *Précis of Technology*. Of course, the critic to whom he so politely replies was the Editor of this Magazine. We do not print leaders written by anonymous contributors. In regard to the concluding paragraph of the above letter, it will be apparent that we discuss one thing at a time and did not deem it expedient to mix criticisms on the technical writing with comment on the technology. Mr. Bensusan has done excellent work, as was properly recognized by those who discussed his paper when it was read before the Institution.—EDITOR.]

Rusty Gold.

The Editor :

SIR—My letter, in your last issue, omitted the word "sodium" in the description of the adaptation of the electrolytic principle to a Western American mill. The paragraph should have read: "Sodium amalgam was used upon the plates and regenerated from salt purposely added to the ore."

The reason for noting the use of sodium amalgam was that Robert H. Richards in his 'Ore Dressing,' Vol. II., page 752, says: "Sodium amalgam has a powerful reducing action, reducing the metal from oxides, sulphates, sulphides, chlorides, etc., of base metals, and thereby removes these causes of flouring." I mentioned that possibly galvanic action from the copper-iron couple assisted, because in New Zealand practice, Muntz metal plates (60% Cu, 40% Zn), are largely used, and it is proved beyond doubt there that less sickening of the amalgam by base metals occurs than where copper plates alone are used, the liberation of hydrogen from the water reducing the oxides, sulphides, etc., at least to a considerable extent. A good case could be made for these mercury-covered Muntz-metal plates; they are much cheaper than copper, amalgamate more rapidly, absorb much less amalgam, and 'sicken' less easily.

Regarding the scheme mentioned in the

after part of my letter. A revolving copper cylinder electrically excited; this cylinder must be adjusted with care so as not to offer too much surface above the mercury but yet sufficient to revolve; in case the ore should contain too large a percentage of sulphides this becomes impracticable, as would be the case with mercury riffles and traps also.

ERNEST H. VAUGHAN.

London, January 31.

Accidents in Mines.

The Editor:

Sir—I have read your remarks on page 12 of the current *Mining Magazine* respecting the colliery disaster in Lancashire, which is very sad. But what seems to be sadder still is the fact that the death-rate in our coal mines during the last 12 years has greatly increased. This is a serious reflection on modern science. Had ventilation received that attention which it demands, this would not be the case, and a large majority of our coal mines would be working with naked lights. This old story respecting such mining disasters, that it is the criminal carelessness of one man is nonsense, and this fact should be forcibly brought home to those who should be made responsible, because this is a theory, shirking responsibility, casting reflection on the unfortunate victim, who cannot reply.

W. TILGUE.

Probus, Cornwall, January 23.

Prospecting in the North.

The Editor:

Sir—The contribution of Mr. H. V. Winchell, appearing in your December number, is, it seems to me, of great value. The field of economic geology is so full of attractive problems that even some of those bearing most closely on the economic aspects of the science have received but scant attention. Probably no other phase of the subject has been so much neglected as that relating to outcrops of ores and to the varying effects of different climatic conditions on superficial and related processes. The conclusions of Mr. Winchell, based on a wide experience and knowledge of deposits in different latitudes, should carry much weight.

The fact that glacial erosion may leave intact the zones of oxidation and of secondary sulphides is clearly shown in certain districts of Colorado and Montana. In the Philipsburg area the ice erosion by mountain glaciers appears not to have extended to the top of the sulphide zone, and in general it probably af-

fected only the superficial portion of the oxidized or leached zone. In northern New England, on the other hand, the more vigorous erosion of the continental ice-sheet appears to have removed any portion of the lodes that may have been oxidized or otherwise altered. In certain deposits in New Hampshire the sulphides outcrop at the very surface; no considerable amount of oxidation has taken place below 30 ft. and, in general, oxidation is incomplete at a much shallower depth. The vertical relations are similar to those described by Vogt for certain sulphide ores in Norway. Chalcocite enrichment has taken place to only a trivial extent, the secondary ore consisting of primary yellow sulphides coated with thin films of chalcocite, which adds to its value not more than 1%. There is neither important leaching nor enrichment. The deposits in the southern Appalachians offer the greatest contrast, in this respect, to those of New England. At Ducktown, Tennessee, the oxidized and the sulphide zones do not pass gradually one into the other, but the contact-zone lying like a floor between the two kinds of ore is, at many places, nearly as sharp as a knife-blade. This is due to climatic conditions in part, and in part to peculiar topographic conditions, and is doubtless favoured by the impermeable condition of the primary ore which prevents any active circulation below the water-level.

With the progress of the study of ore deposits, the limitations of our conclusions and generalizations become more and more evident, and the value of such generalizations obviously increases with a knowledge of the limiting conditions. It has been assumed, for example, that the stronger the evidence of fissuring is, the greater the probability that the vein will persist in depth. It is generally held, and with good reason, that a long continuous outcrop generally indicates persistence in depth, and that faulting movements or displacement along a fissure are likewise favourable indications. The work of Reno Sales at Butte, of Ransome and Calkins in the Cœur d'Alene, and of others in various mining districts, shows clearly that great faults with profound displacements are less favourable *loci* for ore veins than fissures along which less tangential movement has taken place. The clay-like friction-gouge seals the openings and diverts the solutions to easier paths. But this generalization, like most others, has its limitations also, for in limestones the hot solutions appear to be able to penetrate the friction-gouge readily. Consequently the faults with appreciable displacement may be strongly

mineralized in limestone country-rock. Aspen and other districts in Colorado are cases in point. Furthermore, the principles seem not to apply to deposits formed near the surface, where, in general, the rock is more highly fractured, open spaces more numerous, and where the ascending hot waters may move about more freely. Among other examples illustrating this feature is the Comstock Lode, a deposit formed very near the present surface along a fault of great displacement.

The metallogenetic epochs, as defined by Lindgren for North America, show important relationships and have come to have a wide significance. I have thought that the use of this term might be reserved for the primary deposits and the term, metallographic province, now used with somewhat similar significance by some and without very definite limitations by others, might be reserved for describing and comparing secondary changes in deposits such as those described by Mr. Winchell—differences conditioned upon geography, physiography and climate.

WILLIAM H. EMMONS.

University of Chicago, January 10.

The Editor:

Sir—I read with interest an article in your December issue by Mr. Winchell on secondary enrichment in northern latitudes and your remarks on the same.

Mr. Winchell's summary is somewhat sweeping, namely, that deep alteration and complete alteration is a much more common phenomenon in (what are now) warm, than in cold, countries and that ore bodies and veins are not so likely to terminate suddenly or change rapidly in depth in the former as in the latter. We have evidence that boreal conditions did not always exist in the northern part of the American continent, in the existence of coal, and there is not much question but that many of the ore deposits now known are of prior origin to the coal measures.

The statement that in general ore deposits are more abundant in warm and temperate zones than in colder climates is somewhat premature, seeing that many parts of northern Canada, Labrador, Iceland, and Siberia are almost unknown. When these countries come to be opened up to the extent that South America, Mexico, and other such countries it may prove that per square mile of surface the mineral wealth is quite equal to, if not greater than, that of temperate zones. Except for gold, is not Canada today a far richer mineral country than Africa?

In contradiction to the statement that oxidation and alteration is a usual condition in hot countries, the occurrences that may be seen in many mining regions in the tropics may be cited. I need only mention one in particular, that known as the Kafue copper district, situated between 13° and 14° south of the equator, in Northern Rhodesia. Here, although the climate is tropical and has probably been so for ages, we find ore deposits that, from Mr. Winchell's conclusions, would point to Arctic conditions. The Kafue copper district covers an area of several hundred square miles and in citing three typical instances, I shall take three mines situated some distance apart so that they can hardly be considered peculiarities of local geology.

At the Sable Antelope mine, the deposits take the form of irregular masses in a dolomitic limestone country; the ore is a mixture of sulphides of copper, iron, and arsenic. These sulphides outcrop on surface in massive form, practically unaltered. The natural water-level is about 40 ft. below the surface. The condition and grade of the ore is the same at the deepest point yet reached—over 300 ft., as at the surface. It would be hard to find a ton of altered or oxidized ore on the property. The bottom of the workings is well below the line of any possible secondary enrichment.

In the Silver King mine, eight miles farther west, the ore is a silver-bearing chalcocite. The main deposit is a pipe-like mass dipping nearly vertically which has been opened up to a depth of more than 200 ft. The nature and value are the same above and below the natural water-level except for the occurrence of a few tons of partly oxidized ore to be seen almost on surface. The third instance is that of the Hippo' mine, some 30 miles farther westward. Here the ore is found as a lode in a country rock of altered clay-slate. The lode consists of a mixture of pyrite, chalcopyrite, and a little bornite, with fluorspar, calcite, and quartz, a material very susceptible to alteration. It shows signs of oxidation near the surface, but above the natural water-level the ore is of the same nature and value as a hundred feet below it. This brings out the point that, speaking generally, present and more recent climatic conditions have left their mark on ore deposits only to a slight, in fact almost negligible, extent, except in a few exceptional cases, to be seen both in Arctic and temperate zones. Many instances could be quoted of considerable and extensive alteration of ore bodies in the colder parts of the North American continent. With a working knowledge of

Southern Rhodesia and Newfoundland, I can say that the change in depth is much more pronounced and sudden in the former, a temperate zone, than the latter, where almost boreal conditions obtain.

These facts are quite opposed to Mr. Winchell's remarks that in temperate zones ore deposits are not so likely to terminate suddenly or change rapidly in depth.

J. M. MURRAY.

London, January 23.

A Protest.

The Editor:

Sir—I read in your issue of October 1909 an interesting contribution from Mr. W. E. Hindry about the Esperanza mine, at El Oro. It contained a great many valuable data. Yet, Mr. Hindry closes his paper with the assertion that it has been necessary to compel a Mexican assayer to use a modern muffle-furnace instead of the old 'pot' muffle to which he was accustomed.

I can say in turn that we Mexicans are "accustomed" to see ourselves misrepresented in English publications, particularly in questions concerning mining matters; but every time we meet assertions like the above, we laugh heartily, inferring that only a deficient knowledge of our country, or an unaccountable lack of good faith, can have induced our critics to make statements so untrue. In the present case, while I am inclined to take Mr. Hindry for an enlightened man, I beg of you to make the statement in your invaluable Magazine that, in the National School of Mines of this city, as well as in every school of mines in this Republic, assayers have been trained in all the ways and means pertaining to their profession, according to the times, since 1792; and moreover, that in the year 1889, when I was a student, we were taught the use, not only of the "modern muffle," but of all sorts of apparatus and methods for assaying and for the analysis of minerals. Therefore I am bound to think that the assayer to whom Mr. Hindry refers was a home-made professional, and not a man nurtured in our national schools.

LEOPOLDO SALAZAR.

City of Mexico, January 18.

Tin in Nigeria.

The Editor:

Sir—I returned to London a few days ago from Northern Nigeria, where I went to report on the Akerre tin district, and it may be advisable to make known a few facts in regard to that locality, for, if more wild-cat companies

endeavour to obtain money for mining enterprises in that district, what I have to say may serve as a warning to intending investors, and to the mining profession generally.

The village of Akerre is situated on the Igberri river about 25 miles to the southwest of Zungeru, the capital of Northern Nigeria; within a few months time it will have railway communication with the coast town of Lagos in Southern Nigeria, the line passing through Akerre on its way to Zungeru. I shall not enter into a history of tin discoveries in Northern Nigeria, as it is well known that during the last few years rich deposits of alluvial tin have been proved beyond dispute to exist in the Bauchi Province. Up to the present time transport has been the chief difficulty, but this will be overcome when the proposed branch line from the Baro-Kano railway to the Bauchi district is constructed.

Some cunning individuals no doubt thought that in the meantime it would be a good opportunity to discover tin in a more accessible locality; so Akerre was chosen, being on the railway and having a good water-supply all the year round. It was reported that tin had been discovered in the river-bed while boring for foundations for a railway-bridge; several claims were taken up, and in some cases the most elaborate reports were made, with calculations and estimates of tin per cubic yard, etc. These were entire fabrications. Well known people in Nigeria were deceived by these reports, and there followed quite a rush to the district. A number of expeditions were at once sent out from England, amongst them being my own, to report on the district and take up claims in the vicinity, if any of value were left. I spent three weeks on the ground and failed to find any traces of tin whatever; likewise all the mining engineers who had been there before and at the same time as myself. The river Igberri, which had been reported to contain alluvial tin, averages in width about 70 yards from bank to bank, but at the time of my visit in December it was the dry season and the water was very low, so that in places its width did not exceed 20 yards. About 20 ft. of nearly vertical banks were exposed to view, likewise a great part of the river-bed. This considerably facilitated prospecting operations. The banks consisted of a fine white sand, there being no signs of a coarse wash, either there or in the bed of the river. Careful washings were made for 10 miles north of the village, and in some cases merely a trace of black sand was obtained consisting of iron oxides. Where this was more plentiful a few

small garnets were detected, but no cassiterite. Over 20 prospect-shafts were examined, some 25 ft. deep, most of them having been sunk to water-level. In no instance had any tin-bearing wash been found, the shafts being sunk either through fine white sand or soft decomposed granite. Numerous bore-holes were put down to bedrock, some in the river-bed, others northwest of the river, the depth in several cases being over 50 ft., but no tin oxide was encountered. One property in the district had been taken up along the strike of an outcrop of granite, this being reported as a tin lode.

The object of these remarks is to show that at the present day there is little to protect the reputation of the mining profession. For instance, in the present case there is nothing to stop an inexperienced man calling himself a mining engineer writing a false report. Afterward, when the truth comes out, the mining profession suffers, as in most cases the public does not trouble to enquire into the qualifications of the expert. The solution of the question is a difficult one and I suppose will never entirely be overcome while mining companies employ unqualified men, but all mining schools would do well to impress upon their students the importance of belonging to one of the recognized mining institutes, and the latter ought to keep the qualifications for membership as high as possible. We can only hope that in time mining companies will learn by experience that it is to their own advantage only to employ engineers thus endorsed.

GEORGE CHESTER MASTER.

London, January 30.

Control and Management.

The Editor:

Sir—In reference to your articles on 'Responsibility of Directors' and 'Control and Management' in the current issue of your magazine, I should like to express my appreciation of your sympathetic attitude towards Mr. R. T. Bayliss, for whom there can be but one feeling in the whole of the mining profession, namely, that of great regard for his exceptional ability as a managing director and cordial respect for his singleness and honesty of purpose. Lord Cowdray and his confreres can have had very little idea of the high moral standing he holds among us all; otherwise, whatever the differences of opinion between them, they could never have acted in such a cavalier way to him. The names of Lord Cowdray and Mr. Bayliss have hitherto stood high in public estimation, and I can only believe, as you indicate in your article, that the former's

judgment of the latter has been prejudiced by wandering from his own well-beaten paths into the uncertain field of mining. If we remember that amateur prospectors are apt to catch a disease known to miners as 'gold fever,' when 'colours' become grains, grains become pennyweights, and pennyweights ounces, all sense of proportion being lost for the time being, then we may have a possible explanation of what otherwise is an inexplicable problem in a man of Lord Cowdray's standing.

The position of directors and the control of mines is a vexed and disputed question, but assuming that the parties seek to carry on the conduct of a mining company honourably and in good faith, I offer a few suggestions. These, though more or less in embryo, I feel sure would, if further evolved, tend ultimately to solve existing difficulties.

1. That at least one of the directors, excluding the chairman, should be chosen for his business acumen and special knowledge of finance. In addition to attending the ordinary Board meetings he should serve on a standing sub-committee. For these increased services the Board should be empowered to vote him a special fee over and above the usual director's fee.

2. That the consulting engineer appointed by the Board should have the *locus standi* of a director, being empowered thus to cast his vote or, if necessity arise, to have his opinion recorded on the minute-book.

3. That the Board's main efforts should be to decide on all questions of general and financial policy, while delegating its powers to a standing sub-committee to carry out the details thereof. In matters of more than ordinary importance, by special request the Board may require the sub-committee to refer back its decision to them for final consideration or confirmation.

- 1a. The sub-committee should consist of three members: the Chairman or one of the ordinary directors, the financial advisory director, and the consulting engineer or the representative of any house under whose technical control the mine may have been put.

In the case of the consulting engineer, if he happened to be in the minority, then he may at his own request have the right to refer the matter to the Board.

- 3b. Where it is impossible to obtain the services of a managing director possessing all the qualifications necessary for holding such a position, both technical and otherwise, such as Mr. Bayliss possesses, the above suggestions would at all events get over many of the

serious difficulties that are constantly arising in the direction and control of mines from London, or even where such services are obtainable they might tend to curb any tendency towards autocracy. The difficulties referred to are so generally acknowledged to exist that it is unnecessary to mention them. Here I should like to mention a fact little known by shareholders, namely, the number of attendances at a company's Board meetings is no index of either the time or the assistance a director may have rendered, it being a common practice to come in for ten minutes during the sitting of the Board, sign, and then go out. And when paid their fees by the number of attendances, it is to my knowledge frequently the case that the director who has rendered the greatest services to the company is the least paid. On the other hand, when directors give their full attention to a company's affairs, there is little doubt that in most cases they are underpaid.

In conclusion, I feel fairly confident that on the broad outlines of the above suggestions, it would lead to much saving of time, both to directors and to the consulting engineer, and would put the matter on a much sounder footing than at present.

E. T. MCCARTHY.

London, January 23.

Mexico Mines of El Oro.

The Editor :

Sir—The Mexico Mines of El Oro incident takes up a large part of the editorial space in your January issue. Yet the diagnosis of the case has failed to discover the real cause of the trouble.

The moral integrity and business ability of the late chairman has not been questioned by his bitterest enemies and his pessimistic speech on the outlook of the mine was based on solid facts and therefore quite justified. The principle has now been clearly established that directors are in duty bound to concern themselves about the market and to warn shareholders against over-valuing prospects. However, directors should not act like doctors called in to reduce painful swellings and cut off abnormal growths; they draw their fees in order to keep the affairs of their companies in a healthy and normal condition. Prevention of disease is better than the cure. Personally, I have never been able to follow the intermittent reports and the exceedingly meagre plans of the Mexico mine, and consequently I have never felt inclined to take an interest in that concern. A red splash

surrounded by black lines and attached to an annual report of a mining company reflects little credit on directors as to informing the shareholders of the true position of the lodes and the ore reserves. I venture to say therefore that if the condition of the mine had always been frankly disclosed to the world of finance, and if full plans and ore-reserve statements had been published, if the dips of the lodes into the adjoining property had been indicated; well, the shares would not have been so absurdly over-valued. The crisis and change of control would never have eventuated.

According to some directors and secretaries of mining companies—who do not know a mine from a hay-stack—most of the shareholders do not care about the details of mine reports, in fact, like most of their so-called 'trustees' on the board, they do not understand such technicalities. But there is such a large number of professionals, of mining engineers, financiers, financial reporters, etc., anxious and able to form opinions and appraise shares with the aid of full reports and plans, that conditions and prices get soon adjusted. To these appraisers and advisers the public are looking for a lead and for enlightenment.

The Golden Horse-Shoe mine, about which concern I sounded the first signal of warning in your magazine, affords a good illustration on the publication of valueless plans. The report of Mr. Kuss leaves no doubt that the manager kept a splendid and probably unique system of records and assay-plans, while the directors appear to have suppressed the reproduction of the ore-reserve plan. This would at once have disclosed the incredible optimism of the manager for including blocks of ground far beyond the development faces. The contrast between his method and the cautious procedure shown by the Ivanhoe and Great Boulder managers would have been at once established.

The lessons are obvious. Careful investors will leave their hands off such companies as publish no plans or insufficient technical data. The number of offenders is legion, in the case of quartz mines—West Africans and Rhodesians, especially—the offence is unpardonable. Keep off the grass, leave the game to the privileged 'insiders.'

THEODORE RUBISCHUM.

London, February 1.

[Mr. Rubischum is a useful critic. We are glad to publish his letter. But Mr. Bayliss's speech was not "pessimistic"; as is allowed,

it was "based on solid facts." In our opinion those facts would have warranted a less cheerful forecast than the statement to which the French group objected.—EDITOR.]

The Council of the Institution.

The Editor :

Sir—Your article in the January issue of *The Mining Magazine*, upon 'The Council of the Institution,' does an unwitting injustice, which you, as a member of the Institution, would be the last to wish to remain uncorrected.

In this article you raised several criticisms and suggestions in regard to the constitution of the Council, mode of election, conduct of business, etc., inviting correspondence thereupon. I have no wish to enter into a discussion of these matters, but would ask your permission to state that they, together with many others, have recently been the subject of very careful consideration by the Council. The alterations to the bye-laws which have resulted therefrom will be submitted for confirmation to a special general meeting of the Institution to be held on February 22; you, Sir, were naturally unaware of this when you published your article.

The proposed recommendations in general, confirm, or more exactly define, the constitution which has hitherto regulated the conduct of the affairs of the Institution. Few of the proposals embodied in your article have been overlooked by the Council, whilst in addition, a large number of other suggestions have been considered with equal care.

The Council have always welcomed suggestions for advancing the interests of the Institution, and, like yourself, are actuated only by the desire to adopt the most effective means for attaining this object.

H. LIVINGSTONE SULMAN.

London, February 6.

The Editor :

Sir—Your leading article in the January issue of *The Mining Magazine* on the Council of the Institution of Mining and Metallurgy will doubtless give rise to a good deal of discussion.

There is not, I suppose, any organization in the world that could not be improved, but few, I believe, in which so complete a change as you indicate would be advantageous. Under existing arrangements the Institution from small beginnings has attained a position of considerable influence, and, as I believe you will agree, has done a quantity of useful work. The objections you raise to the constitution of

the Council may be summarized as follows :

1. It is so large as to be unwieldy.
2. Past-presidents are ex-officio members for life.
3. The arrangements for rotation of elected members of Council are defective and more change is desirable.

The changes you propose are :

1. That the Council shall consist of twelve men.
2. Past-presidents should have one year's life as ex-officio members and then come up again for election to the Council after one year's interval.

As regards the number of members, I do not agree that, in the interests of the Institution, there are too many. The members are all busy men, notwithstanding which most of them act on one or more of the many committees appointed to deal with details, and most committee meetings occupy as much time as a council meeting. When the reports of committees come before the Council all details have been threshed out, and, unless there are special points requiring joint consideration, they are dealt with in but little time. This arrangement makes it unnecessary to have a full council-meeting, and, unless any question of vital interest is on the agenda, the number attending is not unwieldy. With a small Council, such as you propose, each and all of these details would have to be considered at the council-meetings, which would, I fear, have to be more frequent, weekly, at least, instead of monthly, as at present, to attend to the business. It also seems unlikely that all the twelve members would be able to attend these meetings regularly and the affairs of the Institution would thus come into the hands of quite a few, each of whom would, for three years, have nearly as much to do as the president now has for one year. There would, moreover, be little inducement for men who wished conscientiously to carry out their duties to accept nomination on the Council.

As regards past-presidents, some of us at least having passed the chair have thought that we were entitled to a well-earned rest, and attendance has been lax, but force of circumstances has, in some cases at any rate, drawn us back into harness, whether for the advantage or disadvantage of the Institution, I am unable to say. It may be better for us to retire, as you suggest, and only seek re-election if we wish to do so. It seems reasonable to suppose, however, that if re-elected a past-president would be likely to go forward to the chair once more, a contingency which you could

hardly view with equanimity and which would certainly prevent some of us from again standing for the Council. On the whole, I think the present system of placing us on the shelf, from which we can be drawn at any time when we can be of any use, is the best.

The rotation of members of Council is a subject that is always a burning question. Every member of the Institution naturally and properly feels that election is an honour conferred on him, and naturally and properly thinks he should be so honoured at the earliest possible moment. But is the question so difficult? If any group of members thinks an individual should be placed on the balloting list surely a letter to the Secretary signed by them all would be sufficient to provide for the insertion of his name. It is impossible to tell before a man is elected whether he will devote the time necessary for the work or not. If he does, whatever his views may be, he is entitled to the nomination of the Council again at the next election, but if he does not attend to his duties at any time he ceases to receive that support. The interests of the Institution are, I submit, better guarded by the present procedure than would be possible by the scheme you propound, and even the rate at which new members of Council are elected is about the same.

S. HERBERT COX.

London, January 24.

Accidents in Mines.—The Government has issued a preliminary report on mining accidents in the United Kingdom during 1910. It unfortunately shows an increase in the number of accidents and in the number of deaths. This continual increase in fatalities is bound to receive the serious attention of mining engineers as well as of those in administrative authority, as has been pointed out by us last month, and by a correspondent in another part of our present issue. According to the report now issued, the total number of separate fatal accidents in coal and other mines coming under the Coal Mines Regulation Act was 1237, compared with 1182 in 1909. There were 18 explosions of firedamp or coal-dust, 610 falls of ground, 72 shaft accidents, and 390 miscellaneous underground accidents; on the surface there were 147 accidents, of which 71 were on railways, sidings, or tramways.

The deaths caused by the accidents reached a total of 1769, as compared with 1453 in 1909. The total for 1910 included 500 deaths from explosions of firedamp or coal-dust, 634 from falls of ground, 88 from shaft accidents, 398

from miscellaneous underground accidents, and 149 on the surface. Two hundred and thirty-four of the deaths ascribed to miscellaneous underground accidents were due to persons being run over or crushed by cars.

In metalliferous mines there was a total of 38 separate fatal accidents in 1910, being exactly the same total as in the preceding year. Eighteen of the accidents were falls of ground; there were seven shaft accidents and seven miscellaneous underground accidents. On the surface there were six accidents. The total number of deaths caused by the aforesaid accidents was 43, as against 40 in the preceding year. Twenty-two deaths were due to falls of ground, and seven deaths followed shaft accidents, while eight succumbed to miscellaneous underground accidents. Most of these accidents were in the Midland and Southern district, which includes Cornwall, and the remainder were in the Newcastle district, which includes Northumberland and Cumberland.

'Mining and Scientific Press' Annual Review Number.

—We do not publish a yearly review of progress in mining and metallurgy, for the reason that our Magazine is in itself a complete monthly record. A weekly paper belongs to a different category; therefore the *Mining and Scientific Press* of San Francisco finds it desirable in the first issue of every year to take a comprehensive survey of the previous year's work. The issue of January 7 is in every way a remarkable production and contains a wealth of information, views, and opinions. Mr. H. Foster Bain drops the editorial 'we,' and thanks personally his host of friends and supporters for the help they have freely and generously given him. The issue contains reviews of production of all the metals, but the articles on the progress in technology are of greater interest to the engineer and metallurgist. Naturally gold-dredging occupies a large proportion of space. T. M. Gibson contributes an important article on dredging at Nome, Alaska, and Guy A. R. Lewington describes the latest practice in the Yukon. J. P. Hutchins and N. C. Stines give the results of their trials of the Empire hand-drill used for prospecting gravel. Charles Janin and W. B. Winston review gold-dredging progress in California. Alfred James gives his views on the 'Progress in Treatment of Gold and Silver Ores during 1910.' This subject is suitably balanced by an additional article entitled 'American Progress in Cyanidation' written by an occasional contributor, whose identity is not disclosed, owing, Mr. Bain says, to the modesty of the writer.

THE ROYAL SCHOOL OF MINES

By WALTER McDERMOTT.

THE absorption of the Royal School of Mines by the Imperial College of Science and Technology gave occasion for much writing, and still more talking, of a hasty and unreasonable character. The School as it had existed for a number of years was not a distinct entity ; it was incorporated with the Royal College of Science, and was under the control of the Board of Education. It was supported by Government aid of an inadequate amount ; its quarters were inconvenient and insufficient ; it had no proper equipment ; and its professors were so poorly paid that they had to spend most of their time in outside occupations to the neglect of thorough teaching. In the practical world of mining it was known that the great traditions of the past were not being lived up to when considered in the light of the needs of the present ; and it was believed that the prospects for the future were discouraging by comparison with the progress being made by Schools of Mines in other countries.

When the present re-organization was first proposed, there were some (and there are still a few) who took no active or useful part in reform and did nothing but wring their hands and prescribe what the Government ought to do, but certainly never would do. As opposed to these, the great majority of old students of the School backed up enthusiastically the efforts of the Institution of Mining and Metallurgy to direct the movement toward improved technological teaching in London so as to secure the greatest benefit possible for the Royal School of Mines. So far as it is possible to represent the collective wishes of those who can best speak for the interests of the School—that is, the old students—the Institution of Mining and Metallurgy has acted for several years with ample authority ; and it is most important that present students should recognize all that has been secured for them, and all that they might have suffered in a continuance of old conditions. The identity, the name, and the diploma of the Royal School of Mines have been retained ; funds have been provided for the payment of professors on a scale to secure proper talent and experience ; and liberal donations of money have been provided for fine new buildings and equipment, of which a short description is given herewith.

The new buildings are on Prince Consort road, behind the Albert Hall, and immediately adjoining the Royal College of Music. The general plan is shown on the accompanying drawings. The portion devoted to teaching has a frontage on Prince Consort road of 300 ft. with a wing of 150 ft., and width of 40 ft. ; so that each floor has a total area of 450 by 40 ft. Within the angle made by this wing is a low glass-covered building forming the Bessemer laboratory, in which a fully equipped ore-reduction plant is now being installed at the expense of the Bessemer Memorial Committee. This laboratory is 250 by 121 ft. inside ; 55 ft. of its length runs under the wing of the teaching building, and it is separated from the front portion of that building by a narrow cart-way, which gives access to a covered yard, in which are the settling - pits to collect residues.

The unoccupied space between the Royal School of Mines and Exhibition road will be occupied shortly by an extension of the City & Guilds Engineering College, and will make this last a perfectly equipped engineering department of the Imperial College of Science and Technology. Future students of the Royal School of Mines will possess a great advantage in getting a more practical acquaintance with mechanical and electrical engineering, from their association with the City & Guilds College, than was possible in the past.

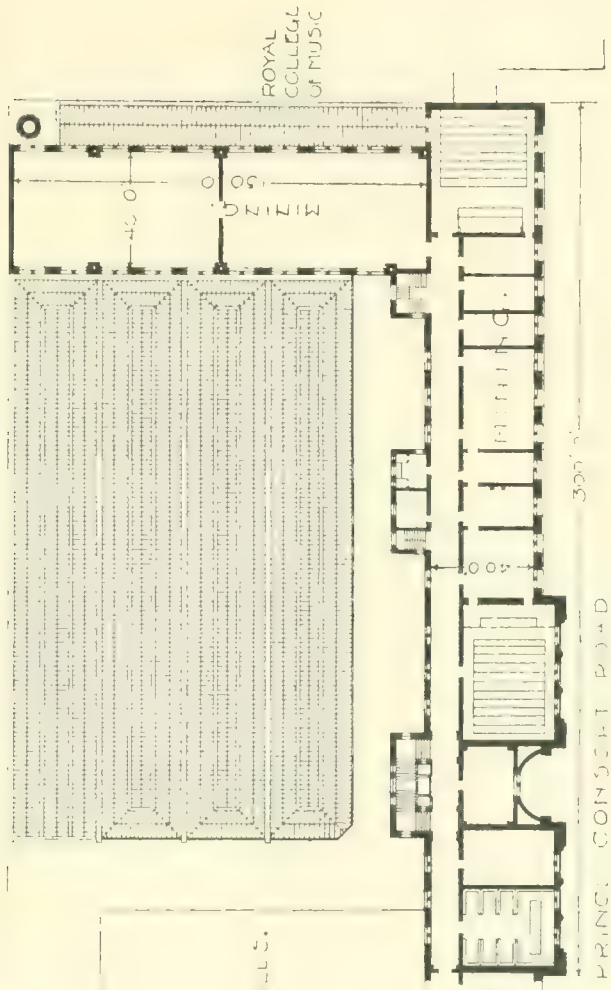
The front basement and ground-floor of the teaching building will be occupied by Metallurgy ; the first floor by Mining ; and the second floor, together with the third floor of the wing, by Geology. Ample space and excellent lighting are secured for all floors, and the equipment will be fully up-to-date, following an examination of many modern schools. A fuller description of the Bessemer Laboratory may be of interest. In its arrangement the following points have been kept particularly in view : The maximum of light to be obtained in a city where excess of sunlight is not to be feared ; plenty of space around machines, and as little shafting and belting as possible ; conditions of automatic working approaching practical mill-work ; sufficient variety of treatment to carry out most of the processes in general use, but without unnecessary multiplication of similar machines, and

PLAN OF THE
PRINCIPAL BUILDING
OF THE EXHIBITION

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OF THE EXHIBITION

PRINCIPAL BUILDING OF THE EXHIBITION

EXHIBITION ROAD.



ample unoccupied space so as to provide for future requirements and for new developments of the arts which may need illustration.

The first and essential necessity of large space was secured through the generosity of the Governors of the Imperial College of Science and Technology, and every engineer who visits the laboratory will acknowledge this generosity with gratitude. Light has been secured by glass roofing throughout, and by windows of most generous dimensions on two sides of the laboratory. The roof is supported on stanchions 25 ft. high and about 30 ft. apart; and these stanchions are all connected by heavy girders 18 ft. from the ground, which provide for all future requirements of support for shafting, piping, lighting, or stages for additional plant. At the east end of the building is a cart entrance from the roadway, and an electric elevator to the ore-floor and gallery 18 ft. above. The ore-floor is 121 by 30 ft., runs across the east end of the building, and is continued as a 12 ft. gallery along the south side, and then as a 6 ft. gallery along the west end. Under the 12 ft. gallery are 9 iron ore-bins of 10 tons capacity each, with discharge-gates above the ground-floor to fill cars running on a line of track to the elevator. These ore-bins will permit of keeping, without dirt or dust, a few varieties of useful kinds of ore ready at any time for illustrative working of the machinery. Under the ore-floor is a large dry-crushing room with one elevator passing up through the ore-floor to a sizing-trommel and shaking-screen, and another elevator passing up to a line of trommels feeding four jigs on the concentration floor. Rails are laid from the elevator along the ore-floor to a Blake crusher at the north end, also along the south gallery over the ore-bins to the furnace department at the extreme west. From the Blake crusher an inclined conveying-belt runs up through the ore-floor, and then along the front of the same. It is fitted with a tripper to deliver to either of the wet-crushing machines in front and below, or to the Dodge crusher that feeds the rolls and ball-mill in the dry-crushing room behind.

Wet crushing is provided for by a 5-stamp 950 lb. battery, a 2-stamp 950 lb. battery, and a 5 ft. Huntington mill, each supplied with an automatic ore-feeder. All these have copper plates, and they are contained in a small wooden house close-boarded on the outside, while inside is a thick felt lining secured to the studding, and held in place by wire netting. This house has double windows on three sides and in the flat roof. The felt lining and air

space of this closed house will greatly diminish the annoyance that would result from running stamps or mill if exposed in the main building.

Surrounding the stamp-house on three sides, and 8 ft. above the main floor, is the first concentrator-floor of concrete; and on this will be placed the first set of tables, vanner, and jigs, so that tailings of these can be re-treated by machines on the main floor below. On this floor will also be placed the fine-grinding machines. Above this floor will be the first of the wet cyanide treatment plant, arranged to get sufficient fall for the convenient handling of both sands and slimes. Magnetic concentrators will be on the main floor.

The main floor of concrete has a regular fall to the west, with two cross-drainage launders, which deliver into two pits, containing pumps. These pits are large and convenient for several purposes. The lower one receives the ends of two main tailing-drains, which run under the floor diagonally the length of the building, with openings in the floor at intervals into which the tailing from any machine can be discharged. At the discharge ends of these tailing-pipes, automatic samplers will be placed; and the various tailings will then be raised by pumps and run outside the building into one of the 5 sets of settling-pits.

The metallurgical department will have a small water-jacket furnace, reverberatory, and electric furnace, and plants for the cyanidation and chlorination of dry-crushed ores. It is intended to equip one room under the ore-floor as an assay-office; for it is anticipated that in future practising engineers, who cannot find facilities elsewhere for certain tests, may be allowed to use the Bessemer laboratory, and would then require an assay-office quite apart from the large laboratory in the teaching building.

Besides the educational advantages secured by the new buildings, the students will have material and social benefits from the large Students' Union building just erected on the opposite side of Prince Consort road. Here will be dining, smoking, and reading rooms, with a gymnasium; and it will be the headquarters of the various sports clubs and other organizations of the three separate colleges.

The Imperial College has been enabled to spend the necessary money for the buildings described, and for others contemplated, by reason of the gifts of members of the firm of Wernher, Beit & Co., and a legacy of the late Alfred Beit, together amounting to fully a quarter of a million sterling. The architect is Sir Aston Webb.

CONSTANT ERRORS IN SAMPLING AND ASSAYING

By L. D. RICKETTS.

MR. LEWIS T. WRIGHT'S article on 'The Element of Chance in Sampling Ores,' which appeared in the November number of this magazine, is valuable, and there is little to be said in the way of criticism, although it may prove of some interest to extend his line of thought. I hope others may be prompted to do so.

The main point in the argument is that errors in sampling and assaying are apt to occur, but that the errors depend on elements of chance and in the long run will offset each other. The theoretical discussion of this same question is carried on at greater length by C. & J. J. Beringer in the eighth edition of their 'Text Book of Assaying.'

In the ordinary methods of assaying ores that are sold, the ore is sampled and a portion of the lot, weighing from 200 to 300 lb., is kept for re-sampling if necessary. The original sample is brought to a pulp and after thorough mixing is sub-divided into at least four portions. One pulp and the portion of re-sample are held under seal by the purchaser for umpire or re-sample. The main point in preparing the final sample seems to be in grinding it fine enough, for the finer it is ground the less will be the probable error in assaying. The control assay, both by the purchaser and the seller, is made in triplicate and an average of the three assays in either case is taken for comparison. If these assays do not agree within specified limits, they can be thrown out and a new assay ordered, or the portion of the ore kept may be re-sampled and the same process gone through. If the assays of the pulps of the seller and the purchaser do not agree when made in triplicate on the re-sample, the umpire pulp is sent to a chemist mutually agreed upon and his control is decisive. As a matter of fact, in the buying and selling of ores, the reference to an umpire is not frequent, and usually the seller and the purchaser agree as to values within prescribed limits on the first attempt. These methods tend to minimize the probable error.

There are, however, errors in special cases which are not dependent on the doctrine of chance and therefore are not subject to Poisson's formula. To these I give the name of 'Constant Errors.' With the single exception of a reference to the personal equation of assayers, Mr. Wright does not take up the sub-

ject of these constant errors, which seem to me to be the more important. Taking his illustration of a pack of cards, if we assume that each card exerts exactly the same amount of friction on the back of the card next to it, and if we cut the pack an indefinitely great number of times, we will get the same number of red and black cuts; but if it should happen that the cards printed in black should slide over the back of the next card with less friction than the cards printed in red, we should find in our indefinite cutting that the black cards appear more frequently than the red, and this difference would be a constant error.

It is, therefore, important that in sampling we should aim to reduce such variation in assaying as is due to pure chance. If necessary, this can be done by more thorough crushing, by thorough mixing before a cut, by taking larger cuts and more of them, and by crushing the pulp to the finest practicable size; but it is more important to provide against a constant error, for in the former case the error will balance if distributed over many shipments, while in the latter case either the purchaser or the seller will constantly get more or less than his due. A conscientious attempt has been made, both by the sellers and the purchasers of ores and bullion, to avoid errors, but it is by no means sure that they are not still of common occurrence, and it may not be inappropriate to discuss the possibility of constant errors in sampling and assaying.

While I was reading Mr. Wright's article, it happened that two specimens of gold ore were brought to me. The ore consisted of a very hard quartz, which was exceedingly tough because it was massive and chaledonic, and the specimens seemed to represent about as hard, tough, and abrasive samples of ore as one could well obtain. These samples were sent to the sampling works and they were crushed, according to our usual method with specimen assays, to pass an 80-mesh screen. When the pulps were sent to the assay-office instructions were given that they should be assayed for silver, gold, metallic iron, and total iron, the metallic iron to be obtained by digesting a weighed portion of the pulp over-night in a solution of copper sulphate and determining the iron dissolved in the solution. The result was as follows:

It will be seen at once that these samples were diluted by some metallic iron, and that the results as to precious metals should have been about 2% higher.

Sample No. 3, a barren quartz of crystalline structure, was sent to the sampling works and ground in the same way but to pass 100-mesh. The quartz was much more friable and brittle than the preceding samples and the pulp showed only 0.66% metallic iron.

The coke we use in our blast-furnaces is rather porous and not very hard. A sample of about four pounds of coarse lumps was broken up to pea size and then mixed and split in a small Jones splitter. One half of the sample was sent to the sampling works, where it was crushed to pass a 100-mesh sieve in the usual way. The other sample was sent to the assay office, and after being ground finer in a Wedgewood mortar and thoroughly mixed and split, was finally ground in an agate mortar to pass a 100-mesh screen. Analyses for ash gave the following result:

	Ash %	
Sample No. 4	17.02	17.15
Sample No. 5	16.17	16.17

In the case of No. 4 the coke contained 1.1% total iron, and in the case of No. 5 it contained 0.52%. The metallic iron determined by the copper sulphate solution gave 0.55% for No. 4 and 'trace' for No. 5. Of course, in burning, the metallic iron was oxidized either to FeO or possibly to both FeO and Fe₂O₃, so that the probable error between the two samples seems to have been small. With denser coke the metallic iron gained in grinding is often much greater than in the case given above.

At Cananea the domestic smelting ore is brought from the mines in train-loads, the cars holding about 30 tons each. These are discharged into receiving-bins at the reduction works. One or more train-loads constitute a 'lot.' The lot is fed at the rate of 250 to 400 tons an hour by automatic feeders to Belt A. It passes from Belt A to a screen made of 50-lb. rails with a 4 in. clearance. The under-size drops to Belt B and the over-size passes through two 24 by 36 in. Blake crushers set with 4 in. maximum opening, and immediately joins the under-size on Belt B. This delivers to a Vezin sampler. The nine-tenths reject passes to Belt C and thence to the beds, and the sample consisting of one-tenth of the entire lot passes to a feeder, which distributes it in a regular stream to Belt X, and by this belt it is conveyed to a

Blake crusher set to crush to 1 in. maximum. After passing the latter crusher, another sample is cut automatically, giving one-hundredth or 1% of the original lot as a sample. This passes to a small Gates crusher set to crush very fine, and the stream is again cut, one-thirtieth of the original lot being taken. This passes to fine rolls, where it is crushed and cut. About 1/3000 remains as the sample. All the reject from this sampling passes to an elevator, from which it is delivered to Belt C. This sample, now under 8-mesh maximum, and weighing from 100 to 200 lb., according to the weight of the lot, is then thoroughly mixed and split in a Jones sampler, to about 4 lb. weight. The 4 lb. is dried and ground in a disc-grinder, split to about 2 lb., screened and ground to pass a 100-mesh screen. The pulp thus obtained is thoroughly rolled in a mixer and divided into four pulps of about eight ounces each. We find this process accurate for the comparatively uniform, soft, lean ores we produce. Custom ore is sampled differently. There is, of course, no notable amount of metallic iron ground into the sample until the disc-machine is reached, but the results of the tests given above show that in cases where the ore is exceedingly hard and tough notable amounts of cast-iron are ground off the wearing parts of the disc-machine and the cast iron dilutes the pulp. With softer ores the dilution may be nearly or quite negligible. The conclusion is that such machines, and also bucking-boards and mullers, should be made of very tough and hard castings, which should be ground to their shape if they are too hard to turn, and manganese-steel or chrome-steel would undoubtedly be a better and safer material to use than grey cast-iron.

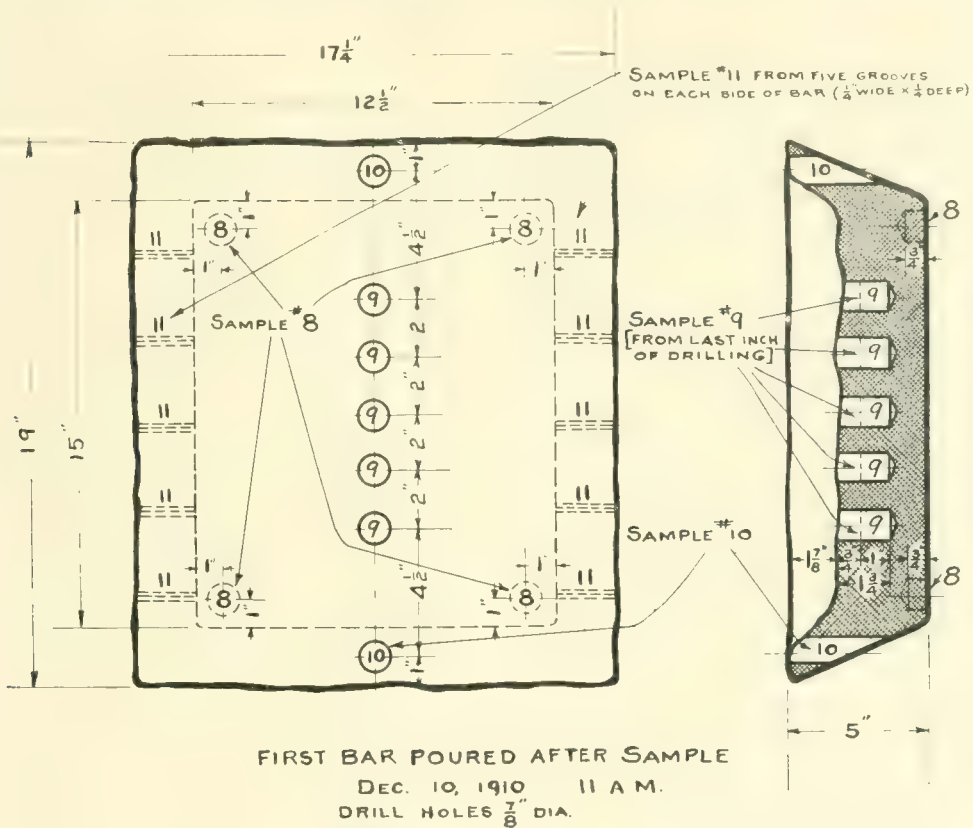
Another constant error is the absorption of silver by cupels, and since this error is now recognized, and allowed for, it need not be further mentioned. Another source of constant error lies in the danger that a sample dried at 212° F. may re-absorb moisture if the pulp contains hygroscopic minerals, and if a considerable time has elapsed between the drying of the sample and its assay. I imagine that ores containing hydrated oxides of iron and manganese or other hydrous minerals would be especially subject to such constant error, and a shipper having this character of ore should make provision that his pulp should be dried shortly before the assay is made, provided that tests show that this step is necessary. Tests from six samples of control-pulps from our office taken at hazard, which had been on hand two months or over, showed as low as

0.05% moisture, but certain samples of domestic ore containing notable quantities of sericite and clays showed as high as 0.7% moisture.

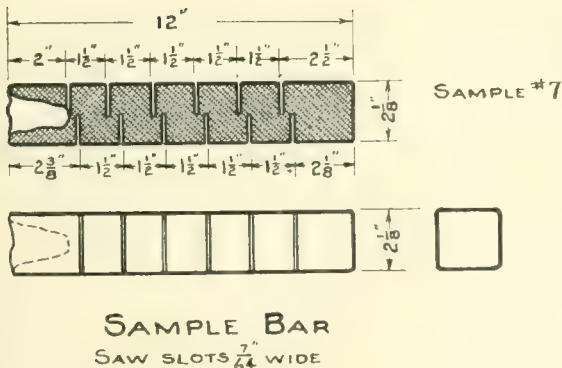
I am not familiar with the cause or conditions under which copper absorbs moisture

refineries and has recently been discussed by Donald M. Liddell.

The variation in the distribution of the precious metals in copper bars poured from the converter is well known, and has been dis-



FIRST BAR POURED AFTER SAMPLE
DEC. 10, 1910 11 A.M.
DRILL HOLES $\frac{1}{8}$ " DIA.



SAMPLE BAR
SAW SLOTS $\frac{7}{16}$ " WIDE

in casting, but it is a fact that under certain conditions copper will absorb moisture that can only be driven off at a temperature higher than 212° F. This fact is now known to the

cussed in the proceedings of the American Institute of Mining Engineers by Dr. Keller. I have not the article in question at hand, and so made a special test at Cananea. At about the middle of a pour of about four or five tons of copper from a converter into the moulds, a sample was poured into a vertical mould of about 2 in. cross-section, and a bar about 12 in. long was cast with a hollow in one end due to the liberation of occluded gases. Immediately after this bar was cast, pouring into the moulds from the converter was resumed, and the first bar cast was set on one side. The sample bar was sawed half-way through by a gang of six

*Moisture in Copper Bullion. *Engineering & Mining Journal*, Dec. 3, 1910.

tiny saws. It was then turned over and sawed back half way through, as shown by the accompanying sketch. The sawdust was taken as a sample, representing approximately the average value of the bullion poured. The copper pig, cast immediately after the sample bar, was drilled with a $\frac{3}{8}$ in. drill, and three sets of samples were taken, as shown. A final sample, No. 11, was taken with a diamond-point chisel from the two opposite sides of the bar. All of these samples were assayed, but the ones taken with the $\frac{3}{8}$ in. drill and with the diamond-point were very coarse and we have no grinding machine to pulverize such drillings. As a consequence, the error in the separate assays of the same sample is great. These samples were all assayed in duplicate for copper and silver, and a composite made for gold, with a check sample for silver and gold. The results were as follows:

	Copper	Silver	Gold
Sample No. 7; Sample Bar.	99.28	54.01	0.26
	99.27	54.2	
		53.8	0.26
Sample No. 8; Drillings from	99.38	40.2	0.24
four corners at bottom.	99.56	39.0	
		40.3	0.26
Sample No. 9; Drillings from last	99.21	90.3	0.34
inch of five holes $1\frac{1}{4}$ in. deep	99.16	86.5	
on centre line.		87.2	0.33
Sample No. 10; Drillings on	99.56	33.0	0.22
bezel two ends.	99.58	33.6	
		32.5	0.22
Sample No. 11; Diamond point	98.16	36.2	0.20
cuttings from side of bar.	98.18	35.0	
		33.0	0.19

An inspection of these results shows the marked fluctuations in the assay-value at different parts of the bar, and the variation in the silver content is relatively greater than the variation in the gold content. We have then bars of copper that show great variation in precious metals in different parts which have to be sampled. At Cananea each lot of copper is sampled in the middle of the pour, as illustrated by sample No. 7. A composite is made from the sawdust of each bar in proportion to the weight of the pour, each composite representing our operations during about 10 days. At the end of the month the precious metal contents are calculated as based on the results of these tri-monthly assays. This method of sampling is simply a check on the refinery, and the refinery sample under the supervision of our representative is final. I understand that at the refinery every fifth bar has one hole drilled through it in accordance with a form that has about 132 different points for drilling, so that when 660 bars have been taken each one of the places marked on the form is repre-

sented. All of the drillings are then, I believe, ground in a grinder and the dust produced is divided into pulps for assaying. While we find great variations, month by month, between the refinery returns and our own, and in individual months as high as 6.75% variation has been noted both in gold and silver, the average for nearly two years between our returns and the refinery returns gives a very close check, as shown by the following table:

COMPARISON OF CANANEA AND REFINERY RETURNS ON BULLION

January 1, 1909, to September 30, 1910.

	Cananea	Refinery	If Refinery 100
Copper, lb.	79,999,894	79,954,068	100.057
Gold, oz.	10,202	10,126	100.76
Silver, oz.	1,857,393	1,869,477	99.30

In spite of this remarkably close check during the period in question, I intend to investigate this subject and see if there is not a constant error in both cases, for under possible conditions the two series might check, and yet the results be incorrect. My reason for this conclusion is that we have in silver and gold monthly variations as high as 6.75%, and another reason is that the exceedingly irregular contour of our bars, due to the shrinkage from the escape of occluded gas, certainly presents greater obstacles to fair sampling than would a bar that had been more evenly cast. We shall in the near future install a casting-machine, which will permit much of the occluded gas to escape before the copper is poured, and the moulds will also be made wider and longer and the bar cast thinner, which is now the practice in most large works. The most striking illustration of a constant error that I have ever known is shown in the variations between the Cananea and the Refinery returns, on the one hand, and the returns of samples taken at the international boundary by the Federal Government of Mexico, on the other. The Government samples are obtained by chipping pieces off the outside of the bar. For a period of one year a comparison of the results shows as follows:

COMPARISON OF CANANEA, REFINERY, AND MEXICAN GOVERNMENT RETURNS IN A GIVEN PERIOD

	Cananea	Refinery	Government
Blister Copper, tons	22,469.02	22,484.12	22,451.78
Silver, oz.	952,536.76	942,235.29	740,044.71
Gold, oz.	5,949.46	5,937.16	7,130.03

We have, of course, called the attention of the Federal Government to this discrepancy, by which it is losing a considerable portion of the Federal tax due from us on the precious metals, and I have no doubt that this matter will be adjusted in the course of time.

PERSONAL

W. H. ALDRIDGE, manager for the Canadian Consolidated Mining & Smelting Co. has resigned and is succeeded by R. H. STEWART.

PHILIP ARGALL & SONS have moved their offices to the First National Bank Building, Denver.

H. BERTRAM BATEMAN has returned to London from Northern Nigeria.

E. H. BRANDT has returned to London from Chihuahua, Mexico.

A. K. BURN is mill-manager at the San Francisco del Oro mine, in Mexico.

P. E. O. CARR is manager for the Mazapil Copper Co., at Saltillo, Mexico.

W. M. CARSWELL, recently at Rio Tinto, has been appointed manager for a copper company in North Queensland.

T. LANE CARTER is in Arizona.

C. R. CORNING, recently in Europe, sailed for New York on January 28.

J. H. CURLE sailed on the *Mauretania* for New York on February 11.

F. DANVERS POWER was here, from Sydney, on a brief visit.

ARTHUR DICKINSON left London on January 20, going to Kongsberg, Norway.

FRANK ELMORE has returned to London from Broken Hill.

HERBERT A. EVANS left for South America on February 8.

W. H. GOODCHILD left London for Cuba on January 21 to take the management of a company owning placers.

ROBERT GORDON, superintendent of the Montezuma mines in Costa Rica, is at New York.

G. W. GRAY has returned to London from Kyshtim, Siberia.

C. S. HERZIG has resigned from the Constant-Herzig Co. and has moved to 42 Broadway, New York.

EDWARD HOOPER is recovering from influenza at Torquay.

T. J. HOOVER has resigned his position as consulting metallurgist to the Minerals Separation Company.

H. L. HUSTON has been appointed manager for the Atbasar Copper Fields.

J. POWER HUTCHINS and NORMAN STINES are at Ekaterinburg, in the Ural region of Russia.

RONALD JOHNSTONE, JR., has returned to Glasgow from New South Wales.

R. H. L. LEE is returning to Honan, North China, for the Pekin Syndicate.

THOS. H. LEGGETT has returned to New York, after making an inspection of copper mines in Arizona.

T. BRUCE MARRIOTT left on February 4 for Venezuela.

G. CHESTER MASTER, lately in Nigeria, has gone to Mexico.

J. H. MEANS has returned from Northern Nigeria.

C. W. MERRILL, LESLIE SIMSON, and JOHN HAYS HAMMOND left for New York on January 21.

C. A. MOREING and J. T. HOLLOW sailed on January 28, on their way to Porcupine.

F. L. MORRIS is due at San Francisco, on his return from New Zealand, on March 5.

C. H. MUNRO sailed from Liverpool, returning to San Francisco, on February 11.

F. W. NORTH has returned from Tunis.

O. B. PERRY arrived from New York on the 8th inst. and has gone to Paris.

J. C. PICKERING is manager of the Buena Tierra mine at Santa Eulalia, Mexico.

H. A. PIPER has been appointed consulting engineer to the Rhodesia Exploration & Development Company.

RUDOLPH RECKNAGEL is at the Abosso mines, in West Africa.

G. A. RICHARD will make an examination of the Waihi mine.

A. M. ROBESON, consulting engineer to the Rand Mines, Ltd., is in England on a year's vacation.

R. H. TOLL has left Denver to go to La Paz, Honduras.

SCOTT TURNER is in Italy.

ERNEST H. VAUGHAN has gone to Northern Nigeria in the employ of the Juba Tin and Power Co.

H. W. L. WAY, formerly in Colorado and Siam, is now living in Essex.

H. H. WEBB has returned from Paris.

ERNEST WILLIAMS has gone to Porcupine, Ontario.

GILBERT WINSLOW has left for Northern Nigeria.

SIBERIAN IMPRESSIONS

By HORACE G. NICHOLS.

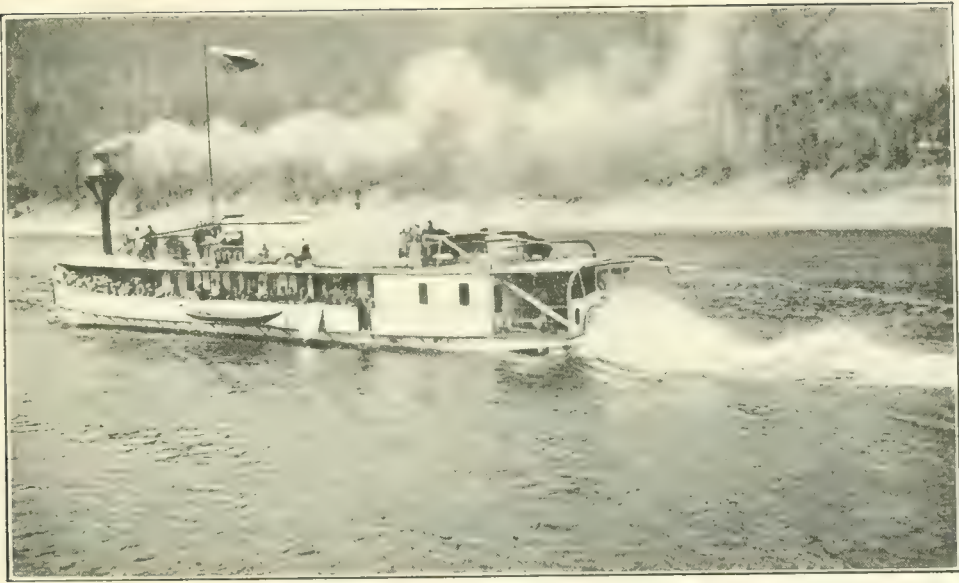
AFTER a summer spent in the outposts of Siberian civilization the return journey on the river Lena is painfully long and slow. As day succeeds day, on this highway through the solitudes of fir and pine, the mental pictures of the hinterland assume their true perspective. Beyond Bodaibo, in the mining camps, they talk glibly of 50 million pounds worth of gold, shipped from this famous alluvial district; where the watchman's rattle at night tells thieves where they may steal in safety; where the clang of the *douga* bell sounds incessantly on the long succession of Government *vodka* wagons, where the workman sells his stolen gold to his employer, who has aided the theft from himself; and where the half-naked untaught children exist, God alone knows how, to inherit morals of the worst and ambitions none; where, in short, the significance of life is often lost in the hum-drum of mere existence.

Back there, the claims of home and civilization leave small opportunity for appreciation of what really lies below the casual reports of Siberian mining; but here, midway, many questions clamour for an answer. How is it that so little is known of this country, which has known no forty-niners, and yet has furnished millions? Is it true, that English capital is back of a system that offers to employees a market for the gold they may steal. Why does the long arm of the Russian Government reach out to the mining districts of Vitim and Olekma to supply vodka but not education? Who has benefited by the extraction of these tons of gold, and the destruction of so many million feet of timber? Why were we taught that Siberia was a terrible country of snow and frost, hardship and exile? Certainly the days during the months of May to September that would not have made an Englishman envious, were few and unremembered. Hot it has been, but always cool at night; cold, but always warm at midday.

This is a short account of a trip from St. Petersburg to the land of the Yakoots and back. The first part of the journey is very different from what it must have been fifteen years ago, when railways over the Siberian steppes were unknown. The Trans-Siberian railway is a big undertaking on which a little insight into Russian militarism may be gained,

and which is being greatly improved by better grading and a double track; possibly improvements will extend to the rolling stock in the direction of increased weight, looking to speedier travel. From the point of view of comfort there is little to be desired. The gauge is 5 ft., and the inside width of the cars is 9½ ft., allowing an amount of ease unknown even in America. The arrangements are good, and on the express palatable meals can be obtained. The passenger rate, including sleeping accommodation, is about 1¼d. per mile. The distance from St. Petersburg to Irkutsk is 3570 miles; the time taken is 6½ days, and the cost of living is about 7s. 6d. per day. From Irkutsk to Zhigalova is the one bad part of the journey, which has to be performed in post-wagons, a distance of 250 miles, in several stages. The service is Governmental, and post-houses are provided along the route, which, however, the foreign traveller would do well to avoid, owing to certain crudities of domestic arrangement that characterize the Russian peasantry. The cost of this journey is 4¾d. per mile, including tips to drivers. Food for the 2½ days should be taken. At Zhigalova one of the 24 steamers plying on the Lena is taken; there is lively competition among these steamers, which vary in respect of accommodation, and perhaps the most comfortable is the Verkolensk, towing a three-decker barge or house-boat, on which private cabins, a shower-bath, piano, and electric light are to be found.

We slip quickly down stream, stopping occasionally to obtain wood. Some three or four hundred miles above the point where the Vitim flows into the Lena, the villages on the banks become more frequent. The dwellings, like a row of card houses, surround a pretentious church. These houses are all built of logs, with white painted window-frames in ornamental patterns, which go far toward relieving the individual monotony, but, seen from the river, their general effect of sameness is wearisome. No doors are to be seen in the front of the houses, the entrance being through a back yard; even the villagers, who have food-stuffs to sell to the passengers on passing steamers, await enquiries behind closed windows, through which they may be seen peering grotesquely. It is best to be content with a bird's eye view of these villages, with the patches of outlying



STEAMER TOWING A BARGE UP THE LENA.



EARLY MORNING AT IRKUTSK

cultivated land, the forefront of green sward or picturesque river-frontage and the background of pines; one impression only can follow closer inspection: filth. Everywhere the women are to be seen working, in the fields, around the houses; the men apparently work only when they have no women to do so for them. No children are to be seen playing on the greens. There is a national Russian game, I am told, by name of *garotke*, but I have seen no sport in Siberia.

At Vitimsk we leave the big river, and steam up the Vitim for two days, arriving at Bodaibo, a town, apparently of some three thousand inhabitants. Here the narrow-gauge railway, belonging to the Lena Company, is taken to Feodosievski, which is the terminal of the railroad, and in the centre of the mining district.

On the whole Nature here has not been kind to the miner, for she has buried her vast hoard of gold either below overburden too heavy and boulders too big to be prospected by drilling or worked by dredge, or in ground so loose and wet that 'drifting' becomes unreasonable, or on hard and uneven bedrock, in the crevices of which the gold is concentrated, and, except in rare cases, where a purely local factor of enrichment is to be traced, the average grade of the gravel is just what will *not* pay to work under existing conditions. Many ingenious contrivances and schemes have been developed in this remote corner of the world; these are the product of local experience, and some curious deductions are met with. Instances of methods in the making are plentiful. In one mine 18 inches of bedrock—not hard—was being taken from the bottom of a drift, with little hammers having handles 6 inches long, held close to the head and struck rapidly. This method was about to be replaced by the use of 3½ in. Ingersoll drills. It is hoped that, by applying the principle of successive eliminations, an efficient mean may be obtained during the life of the mine.

The Government regulations regarding the amount of timbering required are somewhat to blame in many instances, but lack of initiative is chiefly responsible for the antiquated arrangements so prevalent. The book-keeper is the man to afford information regarding the cost per cubic yard of timbering underground, because he has access to the venerable printed official documents, in which this information has been embalmed. Certainly the mine accounts fail to tell the whole story, seeing that such items as "Payment to men who worked on holidays" are important features in records otherwise wearisome in their detail. This same

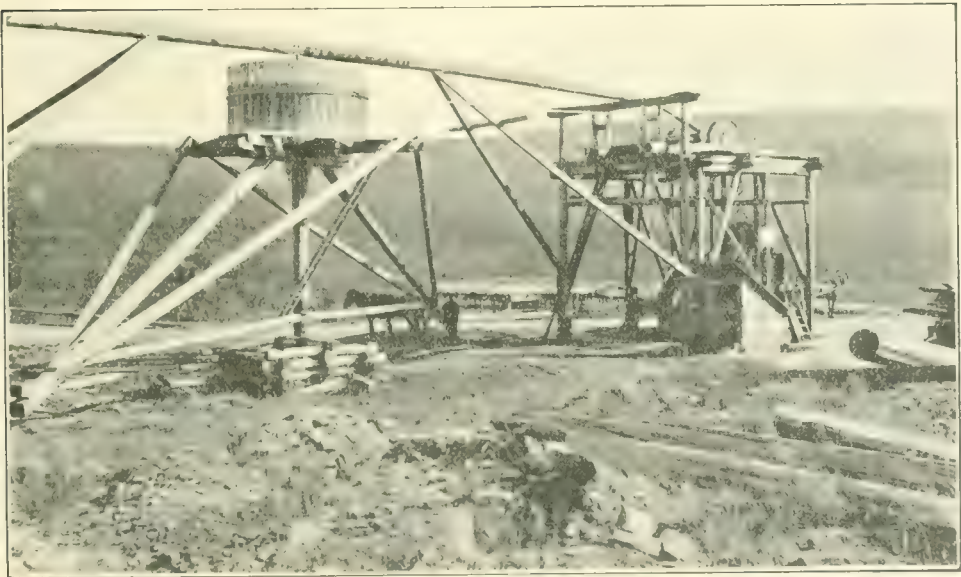
question—the cost of timbering—is pertinent in the case of some mines that have, apparently, anything from 150 to 500 acres of ground ahead of them, and where the overburden does not exceed 60 ft., and the pay gravel is about 20 ft. thick. Here, in addition to building ditches for the water from the river, pumping from shafts ahead of the workings is required in order to keep the headings in workable shape; this is assisted by a system of driving wedges or pegs about 8 in. long, held in place by boards, into the whole of the exposed face and sides as an advance is made. The progress in main headings is at the rate of about 3 in. per day, and it would seem that a more profitable method of working might be to strip the entire overburden by steam-shovel, at a cost of, say, 5 pence per cubic yard, taking slice after slice, elevating and depositing the tailing over the dumped overburden, in place of timbering at a cost of 8s. per cubic yard of gravel.

Precisely the same arrangement and amount of timber is used at the mine just described as at another, where, in stiff ground, the surface water is 'ditched' entirely by means of a dam, 14 ft. deep, made of rocks faced with that invaluable product, reindeer moss, and the workings are almost perfectly dry, a face 12 ft. square standing unsupported for days. Generally speaking, it may be said that the amount of timbering demanded by law is about 50% in excess of the maximum that is actually required under the worst conditions, and the appearance of the underground workings suggests an excavation packed with wood. Lack of design, as exemplified by the absence of all caps to withstand lateral pressure, is supplemented by a superabundance of material.

It is easy to criticize, but in truth all credit is due to the men working in a remote locality, deprived of the chance of comparing ideas and experience, and facing the most difficult natural conditions, with a record of fatal injuries underground that might prompt an insurance company to give its policies away. Some customs there are, however, that are open to criticism without apology, and of these the worst is that whereby the companies place a premium on dishonesty, by purchasing the gold picked up by their own workmen. The men are supplied with sealed tin boxes or safes, similar to those in use on diamond mines, in which they may deposit with impunity the gold that they find while working. On bringing this gold to the office, they receive 75% of the actual value in cash, or, at the company's store, 91½% in trade. Where the gold is coarse, and the mine is wet, the attention of a watchman,



ON THE TRANS-SIBERIAN RAILWAY.



A HORSE WHEEL IN SIBERIA

probably in league with the men, interferes but little with the very profitable exercise of individual enterprise. How profitable this may be can be gathered from the fact that in one year the same paid by one company for such gold was 5% of the entire output, or £52,000, representing an increase of 40% on the whole pay-roll. Why is this done? That it could be stopped is beyond question. Various answers present themselves, but no answer can explain away the fact that the system is immoral, and can result only in degradation. Having regard to the millions spent, the lives of hardship, the fabulous returns from the Government grog-shops, there seems little excuse for a practice so unworthy of a civilized country.

The whole of this district, from which over £50,000,000 worth of gold is said to have been shipped, is not over 5000 square miles in extent, and is characterized by meandering streams, with a flow of from 400 to 2000 miner's inches of water, in valleys from a quarter of a mile to a mile and a half wide, between hills from 3000 to 5000 ft. above the sea and eroded nearly to base-level in a few instances. The bedrock is usually a hard sandstone, and the gold-bearing gravel mostly a micaceous schist, carrying large quantities of pyrite, largely altered to limonite. One interesting instance was seen of a rich placer, averaging about 17 dwt. per cubic yard, which was stated to have been worked in a dry creek (the Soohai Logg between the valleys of the rivers Nigri and Oogakhan) right up to, but not beyond, a vein of quartz, which crossed the top of the divide at about 3000 ft. elevation, and upon which a small amount of work had been done, showing it to carry some gold.

The *vashgert*, or inclined table on which the clean-up is made, depends largely for its efficiency upon the skilled manipulation of the wooden hoe or *grebok*, at the best not a saver of fine gold; it affords, however, an expeditious means of treating the bulk of the material caught in the sluice-boxes. A clean-up from 300 cubic yards of 20 dwt. gravel being splashed about on a *vashgert* is a sight to gladden the heart of a placer-miner, but it would send a shiver down the spine of a mill-man.

Trommels are generally used in the washing plants, but in some cases a special form of riffle gives good results. Tributing is a common practice; the system generally adopted is to charge the tributors 2s. per day for the privilege of working the gravel, the gold recovered by them being delivered at the office, and paid for at the rate of about 58s. 6d. per ounce, which leaves a net profit for the company of about

10 to 15s. per ounce. Many mines that have been worked solely for the higher grade of gravel, and which could not well be systematically worked over again, become profitable under this system, and the tributors will make sometimes 7s. 6d. to 10s. per day, according to official returns, and often, probably a good deal more.

No tax is levied on the gold. A smelting charge of 10%, and a mineral claim tax or *disertine* duty of about 2s. per acre being the sole direct benefits accruing to the Government from the industry.

The Russian Government reserves the monopoly for the supply of *vodka*, which is retailed direct from Government shops, in all the camps, at immense profit, the revenue derived from this source being stated to be £60,000,000 per annum, and statistics indicate that the consumption per capita, among the entire population of a mining district is over 10 gallons per annum. The average wage at the mines is 4s. per day, of which 1s. goes for *vodka*. Bare living costs a minimum of about 50s. per month, and the small balance remaining is sufficiently indicated by the squalid condition of women, children, and homes. Employers supply free lodging, fuel, hospital, and bath, but as there is no assessed value of these perquisites, the real cost of labour is difficult to obtain. The general cost of working, including fixed charges, is about £1 per cubic yard. This amount could possibly be reduced in some instances, and certainly in others.

Something has been said about morals. Let it here be stated that no imputation of viciousness is intended. No suggestion could be less in keeping with the quiet orderliness and doggedness, which are the impressive characteristics of the Siberian crowd. The immorality is rather that bred of ignorance, a bad example, and the incurious receptiveness that is the heritage of serfdom. Miners, following one another up the ladders of a shaft, after working their shift in icy cold water, but with hardly a word spoken; a group of men returning from work, humming a chant in a minor key; some hundreds of men, women, and children waiting camped on the bank of a stream for 24 hours, through a long cold day and night, for the steamer which is to take them back to the south after their season's work, in casual acquiescence, as if they had been doing it all their lives, and expected nothing else; no clamour, no altercations, not even when, the steamer alongside, a surge in the crowd throws a man, overburdened with his worldly possessions, into the icy water. These are the pictures



ON THE ROAD TO BODAIRO



ON THE LENA

that are impressed upon my memory.

It is not for the casual traveller to opine what is the underlying bond of unity, where loyalty to employers, who openly watch one another, seems out of the question, and where the general principle followed is to assume every man to be a thief until you can prove him to be one.

Contrary to the prevalent idea, there is little permanently frozen ground in this district, and shaft-sinking is all done during the winter months. Steam-points are not used, and, strangely enough, dynamite is said to be found quite efficient. The cost reformer has a good field in Siberia. Here, that detestable account called 'General Expense' is in full favour, and often amounts to 50% of the total cost, and the items it embraces are sufficiently indicative of its purpose, such as: 'Sundry gratifications to workmen,' 'Paid to the Pope,' 'Other Works.'

My experience of the Russian workman is that he compares favourably with the native of any country. He is a lusty and slavish worker of small opportunities and many masters, and with more natural courtesy than I have seen anywhere. Likewise, he is cunning, albeit he may not wear a foxy look. The fact is that he is watched and herded and suspected so continually, that the instinct to 'get even' is the natural result, but the courtesy is certainly spontaneous. I have seen the man at the wheel on a steamer, ploughing its way against a swift current, leave the wheel to raise his cap and shake hands with a casual acquaintance coming on deck.

As is the case everywhere, the future of the mines has been prejudiced by the attempt to exploit the rich gravel quickly, and without considering the system best adapted. From my note-book I copy an extract made after a trip underground:

"Present conditions are such that greater efficiency could not be obtained without the use of a stock-whip. For example, the men, bent double, push rough wooden barrows through four-foot ways, and the dumping of the load, in transit, is a matter of course; possibly a tight-rope dancer could balance the barrow better on the narrow, badly laid, and rotten planks. The water pours out freely from every heading, and every opening has to be plugged with brush."

Unfortunately the same procedure appears to be followed even now, and credible information was given that £2 per cubic yard was set as the workable limit in a mine where costs are, as stated, about £1 and the average value of the gravel at the present time is £4

per cubic yard. This is palpably bad policy, and is to be held accountable for the bad conditions, in so many cases, where attempts are being made, as above, to re-work what has been left.

Other mines there are, at the height of their prosperity, and where the water does not bother, in which an immaculate neatness bespeaks the rule of a rigid routine; in these mines it is comical to note the equivocal expression on the face of the piloting foreman, who is undecided whether it were more in order to ridicule the excessive precautions taken or to claim part of the glory for them.

The trip down the Lena, from Zhigalova to Vitimsk, a distance of 700 miles, took 3 days, but coming back against the stream, the little steamer Peter could make but little headway. The fog generally settles down on the river just before dawn, and we have to stop and anchor. The nights are cold, but the men think nothing of lying around on deck, while, in tow, we have a barge with 250 people on board, returning to their homes, who must stand all night, because there is no room to lie down. At each stopping-place they troop out to buy provisions, looking a little dirtier, perhaps, but otherwise unaffected. They get huge loaves of excellent bread, fish, perhaps a little meat, and certainly *vodka*. The bread is excellent, because it is baked in brick ovens. The fish is often the inimitable *stirlet*, which tastes like a delicious blend of eel and turbot.

The distance from Vitimsk to Kerensk, which was covered in one day going down stream, takes 4 days to accomplish on this return journey, and from the last-named place to Ooskoot, an equal distance, where the current is much slacker, 2½ days. At Ooskoot a large pile of mammoth tusks awaits shipment. In the little fore-castle cabin of the steamer, the rhythmic thud of the engine tells of crested billows, tossed from the speeding bows, but a glance out of the window shows the gravelly bottom, under 5 feet of hurrying water, creeping slowly by.

The main thing needed in a trip like this is to accustom the digestive organs to the particular lubricant used in cooking, and also to acquire the semi-somnolent and introspective appreciation that broods around the *samovar*, greatest of Russian institutions. It is impossible to over-rate its influence. The deck of the steamer is specially perforated with five holes to accommodate the chimneys of the five *samovars*, whose capacity is taxed to the utmost from dawn to dark in satisfying the national craving for the weak tannin extract called *chi* or tea.

The steamboat fare for the 940 miles from Zhigalova to Bodaibo is about five guineas, or 1d. per mile, and meals can be obtained on board the steamers for about 5s. per day.

The barge in tow eventually sticks on a rock, a little below Tarasso, and the disreputable looking Peter, its sides adorned with washed and unwashed clothing, meat and other bric-a-brac, after landing us at Tarasso, goes back to its assistance. From Tarasso better progress is made up-stream now that the water is



On the Vitim

low, by taking the post-boats drawn by horses. These are rough flat-bottomed craft, 60 ft. long and 5 ft. wide partly covered under an arched roof, and when drawn by five horses, they skim over the water at a good pace. For a great portion of the way, however, there is nothing approaching a tow-path, and the horses must wade and slip as best they can. The two days thus spent in reaching Zhigalova, a distance of 133 miles, were pleasant, the autumn foliage revealing new glories every hour. We slip by a mountain of old gold, and in the warm

afternoon light a myriad yellow spires penetrate the pines, a splendid mosaic of green and orange, saffron and emerald. Again, a high bank throws the birches against the sky-line, and we see feathery showers of yellowest gold just falling from the clear blue of the September sky. The 133 miles were covered in 45 hours, 8 hours being lost in 9 stops, averaging 53 minutes each. The average rate was 3'6 miles per hour of running time. The cost of a boat, horses, and tips, is about £7. 15s. or at the rate of about a halfpenny per mile. Provisions are taken, but hot water and eggs can be obtained at the post-houses.

From Zhigalova we again take the tarantass or carriage drawn by three horses, stopping at the post-houses, which are, approximately, 13 miles apart, to change horses. Here we have some trouble, as we are passing through a more settled country, and it is harvest time, and not even the official documents with which we are armed, are able to produce the required number of animals at short notice. On this journey, it took 70 hours to cover 250 miles, the average rate of travel being 5'68 miles per hour of running time, and 26 hours being lost in 14 stops, averaging 1 hr. 52 min. each. The cost of this part of the journey is about £4. 10s. for horses, and tips of about 8d. each to drivers. A private carriage can be hired for the entire journey, thus doing away with the inconveniences of changing carriages at each station, for about 30s. making a total of about £6, or at the rate of about 4½d. per mile.

Let no one attempt this trip without two or three pillows. This is the advice of one who travelled for three days and nights without one. For a trip to Siberia it were well also to take the following: smoking tobacco, chloride of lime, a chafing dish, some light literature, and a knowledge of Russian.

Extraction of Zinc.—In British patent 18817 of 1909, W. Hommel and H. T. Durant describe a modification of the process for extracting zinc from complex ores by means of sulphurous acid. The ore is roasted and then mixed with water and treated with sulphurous acid. The zinc is dissolved as bisulphite, and after the solution is withdrawn, lime or chalk is added to it and the zinc precipitated as oxide and monosulphite. The precipitate consisting of these zinc products together with various lime compounds is mixed with carbonaceous matter and treated in a blast furnace. The result is the removal of the zinc as oxide. The lime compounds remaining behind are used in the next precipitation.

SINGLE SHIFT

By C. BARING HORWOOD.

DURING the last few years the advantages of working a mine with one shift of men only are gradually becoming recognized on the Rand. There, the prevailing custom of having a big tonnage developed ahead of the mill lends itself particularly well to this method of mining, and the wonder is that it has not been adopted earlier. In the past a big ore reserve has, however, not always meant a correspondingly large number of faces available for work, as several mining companies have found, to their cost, when, after the capacity of the mill has been increased, the time has arrived for starting the additional stamps. It is obvious that before a mine that has been worked on the double-shift system can change to single-shift, the number of working-faces must first be increased, to such an extent that the same amount of ore can be won as when two shifts per day were employed. According to circumstances this will take a longer or a shorter time, in some cases as much as twelve months.

On mines where the single shift has been adopted, it has been found that a higher and more uniform grade can be maintained; better supervision is obtainable; the efficiency of men and 'boys' (that is, natives) is increased; costs have been reduced; and ventilation and working conditions improved. It is not too much to say that on the Rand under normal conditions, by adopting this method, the underground costs can be reduced by from 6d. to 1s. per ton mined, according to the special conditions obtaining in each case.

The advantages to be derived may now be considered in some detail.

A higher grade can be maintained because each 'stopper' is directly responsible for the shape of his stope-face; having no convenient partner on the alternate shift whom he can blame for bad work, he is not likely to break an unnecessary amount of waste, and the stoping-width will thus be kept down; he will take greater pride in getting his stope in good shape, maintaining it so, and keeping on the right 'reef.'

As regards supervision, shift-bosses are more rapidly able to form an opinion of the capabilities of both 'stoppers' and 'developers.' The responsibility for the proper working of any one part of the mine is dependent

on one shift-boss instead of two. The manager and mine-captain are also able to follow more closely the work of those under them, and any blame can more readily be allotted.

Greater efficiency is obtained, since, as already mentioned, each stopper is directly responsible for his working-face; therefore, having once shaped his stope and having no partner to spoil his benches, when working on single-shift he is being constantly educated in breaking ground, as he daily sees the effect of his own operations instead of the result of those of his partner. The natives also are continually being educated in the same way; and since they are working only on day shift the number of 'boys' loafing in the compound is reduced. In development work also there will be less likelihood of a man missing the ore, known locally as the 'reef.'

As a direct result of better supervision and efficiency, the cost of breaking ground is appreciably reduced. Greater efficiency naturally means the employment of less men and 'boys' for a given tonnage. An engineer well known in the East Rand informs me that, in his experience, the amount of ore broken when on single shift is 1'3 tons for every ton broken when working with double shift. Two other noticeable items of expenditure, explosives and shovelling, are lowered as a consequence of the miners taking a more intelligent interest in their work, and thus keeping the stope-faces in better shape.

The condition of the air underground is much improved, as blasting only occurs once in 24 hours; although the total number of men and 'boys' employed underground may be nearly the same as when working with two shifts, there is a very much longer interval between the times during which the mine is in work. Both men and 'boys' are living under more normal and natural conditions, since they are working during the day and resting at night, and for this reason alone their efficiency must be greater. Among minor advantages, more time is available for work of repair, and for examination of shafts; smaller staffs of police 'boys' are needed in the compounds; and, the handling, sharpening and distribution of both hand and machine-drills, and also of timber, is greatly facilitated.

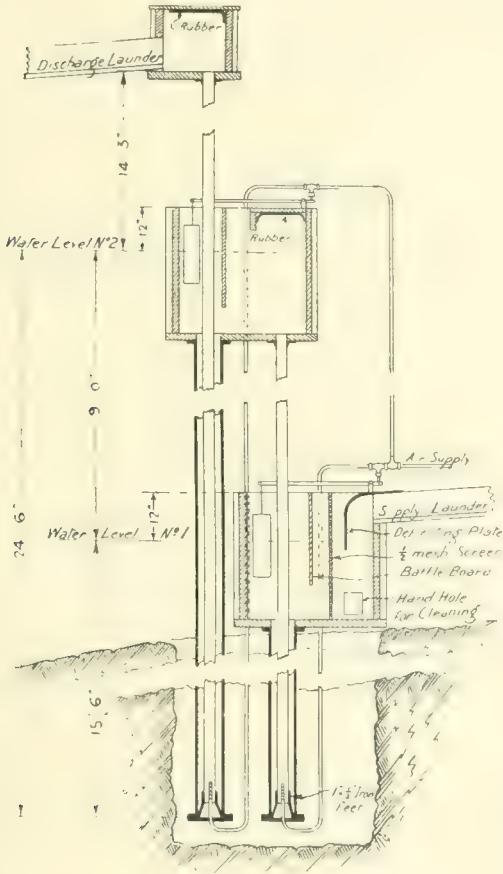
PRÉCIS OF TECHNOLOGY

Two-Stage Air-Lift.—In the November issue of the *Monthly Journal* of the Chamber of Mines of Western Australia, A. R. Mill describes a two-stage air-lift pump for raising and transporting sand residue employed at Burbanks Main Lode mine, $4\frac{1}{2}$ miles south of Coolgardie. The problem was to carry the sand tailing from the cyanide vats across a public road; this involved the raising of the material to a height of 23 ft. 6 in. The Pohle air-lift is sufficiently well known not to require description here except to say that the water, liquid, or pulp is raised by means of a jet of compressed air. To obtain a lift of 23 ft. 3 in. it would have been necessary in this case to sink a pit 39 ft. 6 in.

the discharge launder. The supply of air is regulated by means of floats, so that a nearly constant level is maintained in each head-box and no air is blown to waste. The sand is heavy and the proportion of water to sand in the pulp is $2\frac{1}{2} : 1$. In connection with the discharge of the sand from the cyanide vats it has been found economical to abolish hand-shovelling and to use compressed air instead. Some of the added water is heated by being passed over waste-steam coils; this adds to the efficiency of the lift. The installation was favourably circumstanced for the measurement of power required, and the figures given by Mr. Mill relating to the work done by the two lifts combined will facilitate comparisons with other pumps.

Cubic ft. free air per minute	47
Lb. sand per minute	320
Lb. water added per minute	800
Lb. sand per cu. ft. free air	6.8
Lb. sand and water per cu. ft. free air	23.83

Tin Mining in Texas.—The United States is a large producer of most minerals and metals, but there are certain exceptions, notably precious stones and tin. The geological indications of these are not clear to the average prospector, and have probably been overlooked. Occurrences of tin have often been reported in the United States. English investors lost millions of money at Harney Peak in Dakota fifteen or more years ago. American users of tin must have spent much money on prospecting expeditions; it is evident that local supplies would be of great convenience to the manufacturers of tin-plate. Many reports have been circulated about tin ore in Texas. *The Mining World* (Chicago) gives a description in the issue of December 31 of these tin deposits. The property is situated at Mount Franklin, 16 miles from El Paso. When it was originally discovered it was supposed to be auriferous and much prospecting was done from this point of view. In 1899 a company called the Florella Mining Co. was organized for the purpose of testing the tin ore which had in the meantime been identified. Nothing came of this, and it was only in 1909 that H. S. Chauvenet, of Philadelphia, actively undertook the development, having formed a company called the El Paso Tin Mining & Smelting Co. Under his direction work has been prosecuted with great activity, and not only have the orebodies been proved to be valuable, but a concentrating plant and a smelter have been erected, and are now in regular employment. The tin occurs as cassiterite in quartz veins which penetrate granite. As usual with tin, the veins vary from knife-edge thickness to 2 ft. or more, and in some places lenses of ore are found carrying large amounts of cassiterite. For instance in one place 20 tons of ore was mined averaging 20% tin, and in another 10 tons of ore of similar richness was found. So far, seven distinct veins striking west have been found, and developments are proceeding on all of them, some by adit and others by open-cut. Many branching and cross veins are found, and the granite in the neighbourhood of the veins contains appreciable quantities of cassiterite. In some places the orebody is of the nature of a stockwork. The ore so far treated averages 2% tin and it is expected that this quality can be maintained. The method of concentrating the ore forms a departure from the practice usually associated with tin-dressing, inasmuch as the dressing on tables is done in the dry state. This system has been adopted owing to the scarcity of water. The dressing plant can treat 50 tons per day, but is only working one shift at present. After crushing by rolls, the ore from $\frac{7}{8}$ in. to 8-mesh goes to jigs, and the middling product goes with the ore passing 8-mesh



By making the lift in two stages it was only necessary to sink 15 ft. 6 in. The accompanying illustration gives complete information of the arrangement of the two head-boxes and pipes. The wells for the pulp are made of 6 in. cast-iron pipes. The inside pipes are of wrought iron 3 in. diam., and the air pipes $\frac{3}{4}$ in. diam. are introduced within the latter in the way shown. The air outlets are made in the form of slits at an angle of 45° thus giving the jets of air an upward direction. The air rising up the centre pipe draws the pulp from the space between the two pipes. The first lift discharges the pulp into the upper head-box, and from here it goes into the second well, to be raised to

about 1 ton, containing 60% metal. The concentrate is used for reduction purposes, and the heating is done by means of oil-fuel. Power is supplied by a Hornsby-Ackroyd gas engine which also uses the same oil-fuel. The elevation of the mine above the sea is 4500 ft., and the engine, rated at 65 hp., does excellent work.

The company has erected a reverberatory smelting furnace for the treatment of the concentrate. Anthracite is used for reduction purposes, and the heating is done by means of oil-fuel. Power is supplied by a Hornsby-Ackroyd gas engine which also uses the same oil-fuel. The elevation of the mine above the sea is 4500 ft., and the engine, rated at 65 hp., does excellent work.

The Metals of Old Japan.—In May last Professor William Gowland delivered the first annual lecture before the Institute of Metals, his subject being 'The Art of Working Metals in Japan'. This lecture has only just been issued in printed form, hence the apparent delay in publishing a notice of it in our columns. The work described by the author refers to Old Japan, and he does not deal with processes or methods introduced from other countries since the opening of the country to Western influences. The source of gold was chiefly river gravel, and sometimes quartz veins were worked. In the latter case the quartz was broken with hammers and ground in mills, and the gold extracted by washing in the same way as that from the gravel. The operations were skilfully directed, and leaner ore and gravel could be treated at a profit than is possible nowadays. The washers did not receive any pay, but sufficient gold adhered to their garments to recompense them for their labours. As regards the abundance of gold, the old travellers used to tell greatly exaggerated stories, for they mistook ornaments and plates in the temples and buildings that were made of copper and covered with gold, for solid gold articles. As a matter of fact gold was scarce, and the sumptuary laws as far back as 1000 years ago regulated to a nicety the uses to which gold might be put. When the author first visited Japan 38 years ago, similar laws were still in force; the only gold ornament allowed to a lady was a single hairpin, and gentlemen were confined to gold mounts for sword, pipe, and tobacco pouch. Since then this simplicity has come to an untimely end, and the increased production makes it possible for man and woman to array themselves in the fashion of the West. In the old days the gilding of images and shrines was an important matter, and nearly all the gold produced was used for this purpose. The thickness of the metal coating was much greater than that of modern gold leaf, so that large amounts were used. For instance, in the gilding of the statue of Buddha at Nara in the 8th century, quite 6000 oz. was used. The method employed for giving this gold coating to copper was based on amalgamation. The copper article was immersed in plum vinegar in order to obtain a clean surface, and it was then washed and dried over a brazier. While still hot, mercury was applied to it so as to produce an amalgamated surface. Gold was then placed upon it in the form of leaves, and the whole heated to a higher temperature so as to volatilize the mercury. Other uses of gold were few. In some cases in later years small capsules or bags of gold-dust were used as a medium of exchange. Gold plate was unknown, and even the richest nobles possessed few articles, such as gold cups for wine. The only large gold vessels ever seen by Mr. Gowland were two caskets that came from a temple. These were melted in 1883. They were made of an alloy containing 67.8% gold and 29.3%

silver, and the weight of the two together was 291 oz. The first recorded coinage in Japan was made in 1570 and the gold coin then made was called an 'oban'. It was an oval plate measuring 7 by 4 in. and weighed 1.5 oz. There were also other smaller coins, and in addition uniform bars of gold 13 by 6 by 5 in. were kept in the treasury as reserves against war, pestilence, and famine. Owing to the large proportion of silver in these gold coins their colour was nearly white, so that it was necessary to give them a coating of gold. This was not done by gilding, but by dissolving the silver from the surface layers. The coins were covered with a mixture of iron and copper sulphates, potassium nitrate, calcined common salt, and resin, all intimately mixed and made into a paste with water. They were then heated to redness on a grating fitted over a charcoal fire and afterwards immersed in a strong solution of common salt. The surface silver was thus removed, and on washing and drying the coins were found to have a surface of pure gold.

Silver was not much used in old Japan, for its cold and sober colour was not fitted for gorgeous display in the temples, but many specimens of ornamental work are still extant and also silver coins. It was usually alloyed with 5% copper. In later days much of the silver used contained larger proportions of copper, and in order to improve the surface the articles were treated for the removal of the copper in the outside layers and the production of a silver-white surface.

More important in the arts than either gold or silver were the alloys of gold and copper, and of silver and copper, called respectively shakudo and shibuichi. These alloys were prized for the beautiful black and gray surface coating or 'patina' which could be produced upon them by certain treatment and which made them thereby suitable as the ground for inlaid metalwork. Shakudo consists of 94 to 98% copper, 1 or 2% silver, and 1 to 4% gold. The highest class contained not less than 3% gold. These alloys are of a dark copper colour not much different from ordinary bronze. To produce the desired coating or 'patina,' the objects are boiled in a lye of wood ash, polished with charcoal powder, and immersed in plum vinegar containing common salt; subsequently, after washing to remove all trace of alkali, they are digested in a boiling solution of copper sulphate and verdigris to which nitre is sometimes added. The result is the production of a beautiful black surface with a violet sheen. Quite recently a black patina has been produced on bronzes containing no gold. After the war with China ten years ago, it was decided that medals should be struck from the bronze guns that had been captured, and in order to give these medals a more dignified appearance the Japanese mint added small quantities of iron-arsenic speiss to the bronze, and treated the surface of the medals in the same way as the shakudo, with the result that an excellent black patina was obtained. The shibuichi alloys are of more importance even than the shakudo. Their composition varies widely from equal parts of copper and silver to 1 part of silver and 5 parts of copper. When cast these alloys have the appearance of pale gun-metal or pale bronze. By a treatment similar to that of shakudo a beautiful gray patina is obtained.

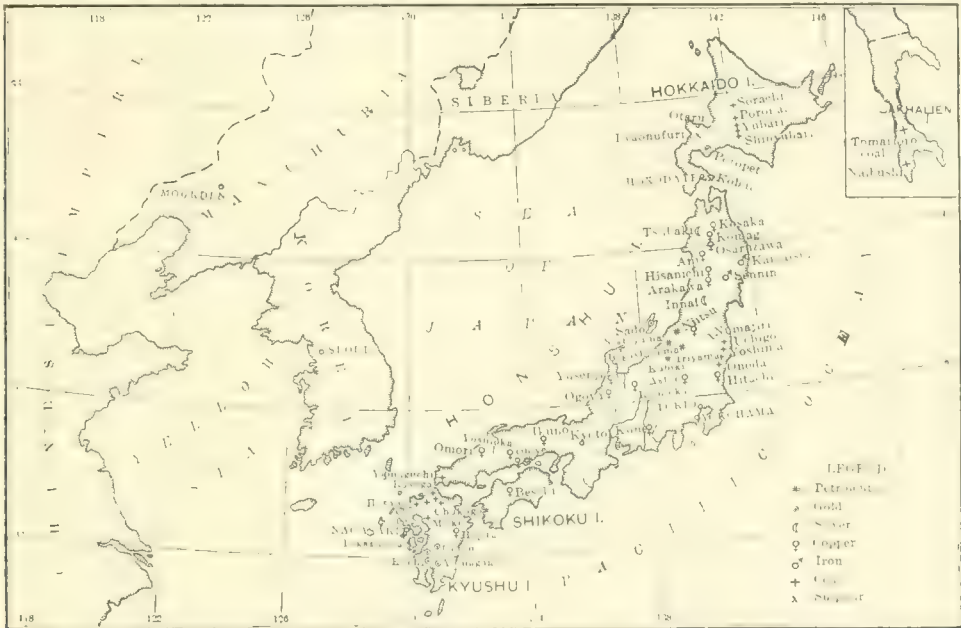
The second half of Mr. Gowland's paper describes the old Japanese metallurgical processes for smelting copper ores and for casting copper and its alloys. He devotes attention to a description of the constitution of Japanese bronzes or 'karakane.' These vary widely in constitution but the point in which they differ from

Western bronzes is that lead is always a constituent. The analyses show from 70 to 90% copper, 2 to 8% tin, and 5 to 15% lead. Often arsenic and antimony are added for the purpose of increasing the hardness and of obtaining a sharper impression in the casting process. The use of lead results in the lowering of the melting point and a greater fluidity, and it also makes possible the production of fine patina effects.

Gold and Silver in Japan.—Following on Mr. Gowland's article on metal working in Old Japan, we may quote appropriately an article on modern gold and silver production in that country written by Ernest A. Heber and published in *The Mining Journal* for January 21. We reproduce also a map of Japan that appeared in a recent issue of *The Engineering Magazine*. Mr. Heber gives the figures of output for 1909 at 153,000 oz gold worth £633,780 and 4,515,000 oz. silver. Many of the gold mines now working were discovered

ore is hand-picked and concentrated for the removal of sulphides, which are smelted in a lead blast-furnace, and gold is recovered by amalgamation and by cyanidation of sand and slime. The largest silver mine is at Tsubake and belongs to K. Takeda. During 1908 the output was 1,250,000 oz. The ore is a mixture of blende, galena, and pyrite in a silicious gangue. The smelting is a difficult proposition and it is made additionally troublesome by alumina and barite in the gangue. The Ikuno mine already mentioned is a large producer of silver, the yield being 212,000 oz. in 1908, together with 3500 oz. gold and 1000 tons copper. The Kosaka copper mine in Honshu, owned by Fujita & Co., produces gold and silver as by-products, the figures for 1909 being 10,900 oz. gold and 1,127,000 oz. silver.

Electrolytic Copper in the United States.—The *Engineering and Mining Journal* for January 7 gives



MAP OF JAPAN SHOWING MINERAL DISTRIBUTION.
(From *The Engineering Magazine*).

in the 17th century, and in recent years 10 substantial producers have been started including the important one at Hasami. From time immemorial placers have been worked and have represented about 20% of the total production. In 1890, the Yesashi placer in Hokkaido was discovered and for several years yielded richly; since 1904 however its production has gradually dwindled. The largest individual gold mine is the Hasami in Kyushu, and at the present time the metallurgical plant is being completely rebuilt. Before these improvements were undertaken the yearly output was 6500 oz. gold and 53,000 oz. silver, figures which will be probably increased ten-fold within the next year or two. The company with the largest gold and silver interests is the Mitsu Bishi Co. which owns mines at Ikuno, Sado, Makimine, and Osaruzawa, which together account for about 22,500 oz. gold per year. Of these the Sado is by far the most important yielding 13,740 oz. gold and 113,652 oz. silver in 1909. The gold occurs free and in combination with chalcopryrite, and the silver occurs chiefly as argentite. The

a list of the companies in the United States using the electrolytic method for refining copper, together with the yearly capacity of the respective works, as follows:

Name of Company	Capacity in Tons
Nichols Copper Co., Laurel Hill, New York	145,000
Raritan Copper Works, Perth Amboy, N.J.	140,000
Baltimore Copper Smelting Co., Baltimore	100,000
United States Metal Refining Co., Chrome, N.J.	80,000
American Smelting and Refining Co., Perth Amboy, N.J.	65,000
Balbach Smelting and Refining Co., Newark, N.J.	21,000
Boston & Montana Copper Co., Great Falls	21,000
Tacoma Smelting Co., Tacoma	12,000
Calumet & Hecla, Buffalo, New York	11,000
	600,000

It will be of interest to add a few notes supplementing the information given by our New York contem-

plants, and in the connection between some of the mines and the future copper production. The New York report contains the product of the Copper Company's survey. The Canadian works refer to the products of the American and other mines controlled by Anglo-American and also that of the Utah Consolidated. The works of the American Smelting & Refining and the Baltimore companies treat the outputs of the Guggenheim group, such as Boston Consolidated, Nevada Consolidated, Utah Copper, and Balaklava. The Boston & Montana refines products of the Amalgamated group. The Calumet & Hecla works deals solely with the production of the com-

Reverberatory Practice.—In the *Engineering and Mining Journal* for December 31, Lindsay Duncan describes the method adopted by him at the Steptoe smelter for utilizing, for steam-raising purposes, the exhausted coal burnt in the reverberatory furnaces. Coal with a long flame is used in reverberatories and, when the bituminous matter giving rise to such a flame has been burnt, the remaining part of the coal known as 'reverberatory ash' is no longer of any use and is removed. The analysis of this 'ash' at Steptoe gave 69% fixed carbon, 6% volatile carbon, ash 19%, and moisture 6%. This analysis corresponds to 11,400 British thermal units per pound, and it shows that the so-called 'ash' has the same value as a fuel as many lignites found in the west of America. In burning it has many of the characteristics of high-ash anthracite. The power plant at the Steptoe smelter consists of eight water-tube boilers each rated at 400 hp., and as the price of coal is high, experiments were made with the idea of utilizing this reverberatory 'ash.' It was found to have about 60% calorific value compared with the coal used, but it gave rise to much clinkering and consequent clogging of the furnaces. Consequently automatic stoking was unsuitable and hand firing and continual raking of the clinker had to be adopted. Eventually the 'ash' was used in conjunction with coal, with a resulting saving of 350 tons of coal per month, and a reduction in costs of \$15,000 per month.

Mineral Resources of Central Sweden.—In the *Mining and Scientific Press* for January 7, Horace V. Winchell gives an account of the geology and mines of central Sweden based on observations made during a visit to the Geological Congress. To the student of Archean geology and of ore deposits, Sweden is of particular interest. Its great age as a centre of mining and the magnitude of the deposits are two features that appeal to him. Though Paleozoic and Mesozoic strata are found in Sweden, the greater part of the country consists of Archean rocks, gneiss, schist, porphyry, and granite. These have in many cases been profoundly altered, and the ancient ore deposits have had a varied and unusual history. The Archean rocks may be divided into three groups: the gneiss group, the porphyry-leptite group, and the granite group. The word 'leptite' is a new one comparatively, having been substituted for 'hallelintgneiss' in 1875. The porphyry-leptite group includes fine-grained gneiss, schist of many types, especially the dense green rocks called 'hallelfinta,' limestone, dolomite, quartzite, and conglomerate, together with porphyry and allied rocks. Some of the group bear traces of having been originally formed at the surface as lava, tuff, or in a few cases as normal sediments. The leptites are closely related to the others and seem to be metamorphosed rocks of volcanic origin, lavas, tuffs, or tuffites. The porphyry-leptite group corresponds to the designation of 'supercrustal rocks,' a term recently proposed by J. J. Sederholm. The gneiss group includes

also gneiss-granite which is granite strongly affected by regional metamorphism, that is, crushed, foliated, or granulated, often with a secondary parallel structure. The granite group contains a great variety of types, and together with the gneiss-granite makes up 50% of the Archean rocks. The granite has intruded the other rocks and is therefore the youngest, being in fact a real plutonic eruptive. Together with the gneiss-granite and some diorite and gabbro, it forms the 'infracrustal' rocks of the Sederholm nomenclature.

The porphyry-leptite group is associated with iron ore in central Sweden and near Stockholm and along the coast to the islands of Uto, Ormo, Namdo, and Rumaro. These rocks are all bedded, often so regularly as to resemble stratigraphical complexes, but their structure is crystalline and the bedding planes vertical. The iron ore at Uto is quartz-banded hematite, the quartz being gray or reddish and the hematite mixed with some magnetite. Beds of amphibolite rocks accompany the ore and form thin green layers alternating with the iron ore strata. The mines were worked from the beginning of the seventeenth century and operations were continued to 1879; during this period the output was about 2½ million tons. The ore was not of high grade containing only 40% iron. The Nyköping mine is celebrated as a source of lithium, two pegmatite dikes containing this element cutting across the folded orebody. It was here that Arvedson first discovered the element in 1818.

To the north and west of Upsala there are many mines of interest. The Dannemora mine like many other Swedish iron mines was originally worked for precious metals. Its antiquity may be gauged by the fact that in a deed dated 1481, it is described as having been discovered a "few years before." By the year 1545 the production of iron ore had become important. The rocks at Dannemora are crystalline schists with intruded granite and later dikes. The ore is enclosed in a limestone mass and is much mixed with limestone gangue. It consists solely of magnetite having a fine grained structure. Many sulphides, chiefly blende, have been formed by replacement at later dates, and impregnate both the ore and the granite. The Langban mines have produced manganese and iron ores and also argentiferous lead and zinc sulphides. The Persberg mine dates from 1413, and the iron ore is of that excellent quality which has contributed to the high reputation of Swedish iron. Fifty years ago the output was 50,000 tons per year but the figure is now only 30,000 tons. The iron content is 45 to 55%, the phosphorus varies from 0.001 to 0.01%, and the sulphur from 0.012 to 0.025%. The Sala mines commenced to produce lead and silver at about the beginning of the 16th century, and in the early years provided most of the public revenue. At the present time an attempt is being made to work the zinc ore left behind. The rocks consist of crystalline schist of hallelfinta and limestone, cut by granite and porphyry intrusions and by later dikes. Galena is found in the limestone, and in some places copper ores also. There are some iron mines in the neighbourhood also, and the iron is found in the hallelfinta. The celebrated Falun copper mine is about 90 miles northwest of Upsala. It is historically one of the most remarkable mines, for it has been worked without a break for 650 years and at the end of the 19th century had produced more copper than any other mine in the world. Records from 1630 have been preserved. The total output to the end of 1900 is estimated at 500,000 tons of copper, 1 ton of gold and 15 tons of silver. The company owning the mine has many other important commercial interests notably iron mines and iron works.

Shrinkage Stoping on the Rand.—At the November meeting of the Chemical, Metallurgical, and Mining Society of South Africa, G. Hildick Smith read a paper in which he described the shrinkage stoping done on portions of the ore at the Ferreira mine. This method of stoping is not now generally applicable on the Rand, because the parts being worked are too flat, but in earlier days the system was adopted at many of the outcrop mines such as the Rietfontein Estate, Henry Nourse, New Heriot, Van Ryn, Aurora, and Spes Bona, where the dip was 70° or more. The work at the Ferreira described by Mr. Smith consisted of the removal of a block of ore (A), that had been left be-

tween the 400 ft. level, so it was thought best to leave pillars above the 300 ft. level, instead of taking all the ore out from above the level and replacing it by stulls. A stope-drift was cut from a point 15 ft. up the rise, and three passes were carried up, as stoping proceeded, from the 2nd, 4th, and 7th box-holes, and ordinary boxes used for the others. Other boxes were built at the two extreme ends of the stope, and on the west the pillar was stoped away by hand labour and replaced by stulls. The accompanying illustrations show the method of stoping. In his paper the author gives many additional details relating to the cost of erecting the timbering, the method of arranging the benches,

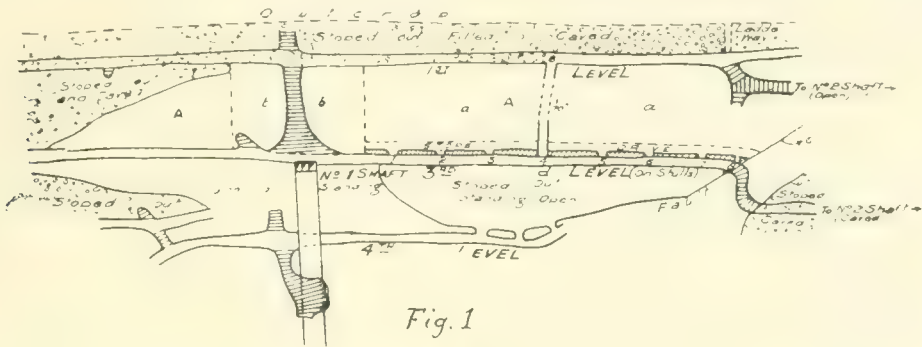


Fig. 1

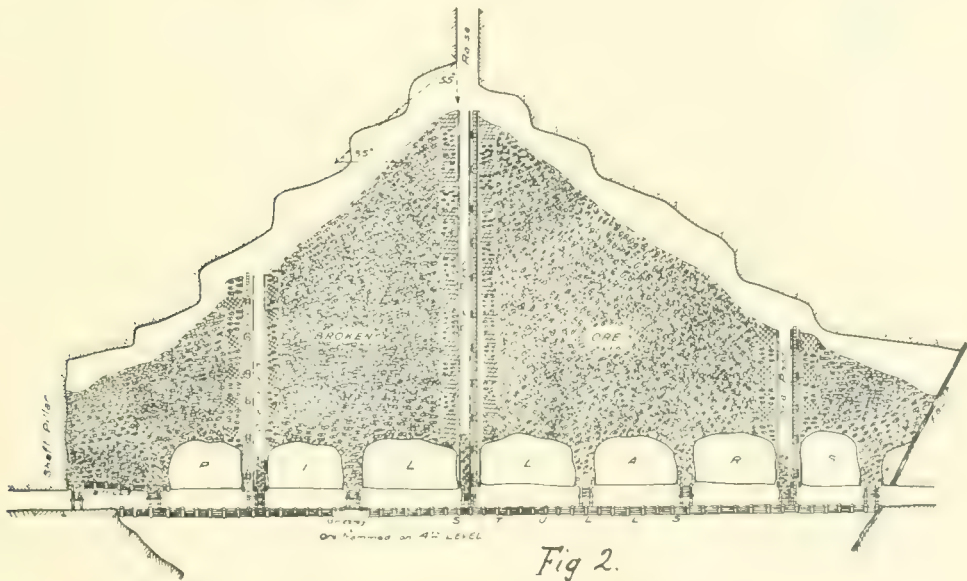


Fig. 2.

tween No. 1 and No. 2 shafts and to the west of No. 1 shaft, between the 100 ft. and 300 ft. levels. On the dip the back measured 200 ft., and the length along the vein was 240 ft. The condition of affairs at the commencement of work is shown in Fig. 1. As No. 1 shaft was above the vein a shaft-pillar (b) had to be left. About half-way along the block of ore on the east of No. 1 shaft a rise was commenced at (d) in the stope-drift on the 300 ft. level, and a winze sunk at (e) from the 100 ft. level. Box-holes 30 ft. apart were put in up to a height of 15 ft. Part of the ore had already been stoped by ordinary underhand methods and stulls put in (see Fig. 2). The hanging wall was safe and the old stope was still in good condition to

and means for bringing the machines and the men up to their work on trestles built on the loose ore. The paper contains no new information about methods of mining, but it is of interest as an isolated sample of present practice on the Rand.

History of Indian Gold Mining.—The *Daily News* of Bangalore, India, publishes a supplement describing the resources of Mysore State. It contains an interesting history of gold mining operations. The author claims that Mysore was the Ophir of David and Solomon, his argument being that the other products mentioned in the Bible, ivory, sandal-wood, apes, and peacocks were known in the oldest days, whereas other countries, such as Rhodesia, cannot give similar

of the Mysore gold fields. The earliest available testimony of the gold mining in Mysore is found in the *Annals of the Kingdom of Mysore*, after Sahasra Raja's death in 1542. It has been recorded that the Mysore gold mines were situated at Shikhar and Chittadroog. The numerous old workings found by the Geological Survey in the neighbourhood of these two towns testify to the importance of the industry in former times. It has also been shown by inscriptions in the Tanjore temples that active gold production took place in the 13th, 14th, and 15th centuries.

In recent times activity dates from 1878 when James Hayes and Walter Elliot obtained a licence to mine for gold near the village of Oorgaum. Mr. Elliot who was the active prospector died shortly after work was started, and his assistants Lavelle and O'Brien continued his work. The first-named found gold quartz near Oorgaum and took it to General De la Poer Beresford at Bangalore, who started a small syndicate among his fellow-officers and acquired the right over 10 square miles. At this time the boom in the Wynaad district on the Malabar coast was at its height and 25 mining companies with a total capital of 5 million pounds had been floated in London, and it was hoped that the proximity of Mysore to Wynaad would be a help among promoters. This hope was not borne out, and no assistance came from London just then. Eventually four companies were formed in India; of these the Madras, Oorgaum, and Balaghat companies were registered in Madras and were under the management of Arbuthnot & Co., and the Kaiser-i-Hind was registered in Bombay. These were small companies formed for prospecting work. Promising ore was struck on the Oorgaum in May 1880, and a trial crushing produced 100 oz. from 40 tons. Captain Bell McTaggart, then attached to the artillery at Bangalore, resigned his commission and proceeded to London with the idea of interesting capitalists. This he was successful in doing, and by the middle of 1881, eleven companies were at work, including the Mysore and the Nundydroog managed by John Taylor & Sons. The years 1881 to 1885 gave disappointing results. In the latter year only three of the companies were actively working, four having closed, and another four awaiting developments. The historical meeting of the Mysore company was held in 1885 for the purpose of winding up. A number of mining engineers had reported adversely and recommended that operations should cease. The only favourable report came from B. D. Plummer the superintendent of the Nundydroog mine. Fortunately he had the support of John Taylor and his views were adopted, though only by a small majority. Work was accordingly continued and Mr. Plummer was made manager. From that day onward the Mysore mine went forward and has won celebrity.

Underground Management. The *South African Mining Journal* for January 7 contains an interesting article advocating the closer supervision of underground mining from the business point of view and foreshadows important developments along this line shortly. The article deserves quoting at length. Concentration and specialization are the two greatest factors of present-day industry. Particularly is this true of mining, and on no field can we study the benefits of these modern aims to greater advantage than on the Witwatersrand. With the growth of the industry, the amalgamation of properties, and the working of larger mines under one centralized controlling head, the specialization of many branches of mining and metallurgical activity has become more and more a feature of the trend of modern practice, and yet much remains to be done in grouping the various branches of surface

and underground work, centralizing control, and perfecting organization. For years it has been evident that mining on the Witwatersrand has become a more steady business, and less a speculation. It is perhaps only natural that these ideas should have found greater scope for application above ground than below the surface. Obviously, it is easier to centralize the accounting department of a big Rand mine than it is to organize and bring under one efficient head the machine men, the whites and natives employed on stopping operations, or the trammers and shovellers. Yet it should be possible to bring all underground employees under some more efficient organization than obtains today, and under the control of some official more directly in touch with all underground employees than the mine manager, who has of necessity to spend much of his time in his office above ground. The mine captain's duty is, of course, to supervise underground operations, to know how development is proceeding at every point, to direct stoping work, control shovelling, tramming, haulage, and to keep in touch with every man who labours in his particular sphere of work. But the mine captain is seldom a business man, and under the present system he is not supposed to be. Any employer of labour on a large scale knows how difficult it is to get a man whose particular forte is manual labour or the supervision of it to do any really good and useful accountancy. He cannot, in fact, be expected to do so.

That there is a real need of an underground business manager on these goldfields is a view to which more than one Transvaal mining engineer is inclining, and it is a matter of considerable interest to learn that one of the leading mining houses has given the matter consideration and may carry the scheme into effect, first of all, of course, as an experiment, on one of the Rand's newer and larger mines. The idea suggests economies in many directions. No doubt much time would be saved if a thoroughly efficient business man established himself underground and took charge of an underground stores and accountancy department. It would not be a difficult matter to establish and equip an underground office in some central portion of the workings, and from this office the mine accounting work might be more efficiently directed. All stores, such as nuts, bolts, spanners, candles, everything used in a mine, in fact, with the exception of explosives, might be accumulated there and drawn on at convenience without having recourse to the often inconvenient and expensive method of sending up to the surface for them and then bringing them down a busily worked shaft. The underground manager would be in direct touch with every item of mine expenditure, every unit of the underground organization, every member of the underground labour complement, white and black. By telephone, too, he would be in direct touch with the manager at the surface, the chief storekeeper, the compound manager, and other departments of the company. In his office all timekeepers' underground returns would be kept, accounts kept of development footages and of consumption of stores, explosives, etc. Tonnages would be calculated and checked, and truck tallies filed. All these returns would be periodically forwarded to the mine office at the surface in order to complete the returns, weekly, monthly, quarterly, or yearly, as might be desired, and a vast saving in time and trouble should result therefrom, whilst at the same time greater accuracy and more vital detail should be obtainable at a minimum of labour.

In this underground office plans of the workings would be kept, and the advantage of having such dia-

accumulation of coarse product. It will be seen that so far through the mill no waste tailing has been formed. It is not until the material has gone into the 3rd or 4th compartment that it is fine enough for treatment on a third set of Garfield and Wilfley tables. Some tailing is thrown to waste off these Garfields. The tailing from the Wilfleys goes to vanners of the Johnston suspended type, as also does the overflow

[illegible]

from the various classifiers after having been de-watered. In the flow-sheet the numbers indicate how many of each kind of machine are in each unit, of which there are 12. The concentrating plants at the Ray and Chino mines are similar in design to that above described.

Origin of Asbestos.—In the October *Bulletin* of the Canadian Mining Institute, A. E. Barlow contributes some remarks on the occurrence of asbestos in Quebec and on the theory of its origin. Owing to some erroneous opinions having been used by the promoters of certain commercial schemes, the author thought it opportune to re-introduce the subject. Though the province of Quebec contains the largest deposits of the highest grade in the world, the subject

these fibrous varieties are usually described as 'secondary' forms. Various explanations and theories have been advanced by different writers, but all have failed to give due value to microscopic examination. The Department of Mines has issued a monograph on asbestos, which does not give a satisfactory answer to the question, nor any geological opinion as to the probable extent of the deposits. Mr. Barlow proceeds to give his views. Asbestos, mineralogically chrysotile, is really a fibrous serpentine, a rock which in its finest form is the result of alteration of olivine. The original rock is known as dunite and is made up of olivine with sometimes some chrome iron ore and pyroxene. Olivine is easily altered by hot water, so that original dunite is seldom found. The gradual alteration can easily be demonstrated by means of microscopical sections. The grains of olivine are converted into fibrous serpentine or chrysotile, first around the edges, and then along lines of fracture, until at length the whole of the olivine has been altered. These results of microscopical examination bear out the observations on the deposits, where we find that the formation of asbestos commences along a line and extends outward from it. Most of the previous descriptions give the idea that the serpentine has undergone contraction, whereas the exact opposite is the fact, for the secondary serpentine is actually 20 to 35% greater than the original dunite. The so-called veins are really cracks that have grown in proportion to the amount of magmatic water. The asbestos has not been transported from a distance so the deposit has no relation to ordinary veins. One of the questions asked of the author was why there should be such a sharp lateral limitation of the asbestos veins. In reply he showed that the magmatic waters were most active toward the end of the old intrusive action immediately prior to the complete solidification of the rock. These solutions were very active in traversing cracks which have a definite relationship or are coincident with the structural planes of the rock. The magmatic waters acted uniformly on both sides of the cracks, but the lines are by no means as sharp or regular as would at first be supposed. Some of the large veins may have been formed by the coalescence of parallel cracks.

The Neglect of Cornish Mining.—In the January issue of the *Records* of the London and West Country Chamber of Mines, J. H. Collins writes on the subject of neglected mining districts in Cornwall and Devon. The drop in the production of tin during the last 15 years has not been due so much to the decrease in the production of mines continuing in operation as to the abandonment of mining in many districts that used to be of importance. The production is now centred round Carn Brea hill, and the only other regular producers that have much to sell are found in the St. Just and St. Agnes districts. The Calstock district in East Cornwall promised a few years ago to show a revival, but the mines on which so much energy and money were spent, Hingston and Clitters, have once more been closed. With the above exceptions it has to be admitted that all the districts once famous as producers have been practically abandoned. It is true that mining operations are being continued at St. Ives, Wendron, Chacewater, and Liskeard, by isolated companies, but these districts generally, as well as those of Breage, Gwennap, Perran, St. Austell, Callington, and Tavistock are now quite neglected. Mr. Collins sees no scientific reason to account for

this widespread abandonment, and considers that with capital and perseverance they should once more become important producers of tin. He does not advocate the reopening of old, deep, mines full of water, but he shows that there are many districts where shallow levels contain ore that would pay nowadays without much sinking and pumping. He instances Wheal Kitty at St. Agnes where many hundreds of tons of tin concentrate has been raised during the last four years from ground between the 300 and 500 ft. levels, in spite of the fact that the mine had been worked continuously for over 100 years.

Mr. Collins describes several districts in West Cornwall in detail and commences with St. Just. This was once and may be again most productive. Levant and Botallack have been working for over a century, and though the present position is unfavourable there is no good reason why operations should not be profitable. The St. Just district is a strip of country on the coast line, consisting of greenstone and metamorphosed slate, averaging $\frac{1}{2}$ mile wide and $4\frac{1}{2}$ miles long. Mr. Collins considers that it is probably unsurpassed in mineralogical and geological interest by any region of equal size in any part of the world. At least 50 lodes are known and many are visible on the cliffs.

In the St. Ives district there are two separate groups of mines. One stretches along the valley southwest from the town of St. Ives towards Towednack, and is contained in a belt 2 miles long and $\frac{1}{2}$ mile wide. The other is further to the south between Trink and Tren-crom hills, extending to the east toward Carbis Bay, the whole area measuring 4 by 2 miles. The average character of the lodes is much the same as that of the lodes in St. Just district. The presence of pitchblende makes the similarity especially notable. The St. Ives Consols is the most important mine in the district and was started in 1816. It yielded much tin and copper, and was notable for beautiful crystals of chalcocite and for rich specimens of pitchblende. During the last two years much money has been spent in re-opening this mine, and in the Giew section toward the northwest profitable orebodies appear to have been found. Wheal Trenwith adjoins St. Ives Consols and its dumps have recently become of interest owing to the large amount of pitchblende found in them. The Providence group of mines is at the east end of the southern St. Ives district and is close to Carbis Bay. These mines were worked from 1832 and yielded much copper and tin; pitchblende is also found there. During the last four years the Tasmanian Exploration Co. has reopened some of them and has erected a 10-stamp mill. Unfortunately most of the money has been spent on surface equipment, and too little underground development has been done. As the mines were worked by the old owners to only a comparatively shallow level below adit, Mr. Collins feels confident that systematic underground exploration and development would be justified.

Another district worth examination includes Breage, Marazion, and Newlyn. It is often included in one district with Hayle and Gwinear, further to the north and east, but the geological conditions are different, as the slate is softer and contains many greenstone intrusions. More copper has been raised than tin, which Mr. Collins believes is due to the fact that the workings are shallow and have not gone down far into the tin. He instances several old mines on the shore of Mount's Bay, that had not been worked to any great depth, but which were troubled with water in the early days. Mr. Collins deserves the thanks of all mining men for these records founded on personal knowledge.

BOOKS REVIEWED

THE METALLURGY OF LEAD.—By Henry F. Collins. Cloth, 8vo. 550 pp., with many illustrations. London: Charles Griffin & Co. Price 21s. For sale by *The Mining Magazine*.

The rapid progress of metallurgical science may be judged from the fact that the second edition of this book is nearly double the size of the first although only 11 years have elapsed in the interval. We may say at the beginning that the author has not followed the example to which we have before now taken exception, in the case of other recent revises of previous editions in Griffin's series; instead of being content to give a bibliography referring to articles describing recent improvements, he has gone to the trouble, for his own benefit as well as for that of his readers, of thoroughly assimilating and absorbing new ideas and giving an intelligent and critical account of modern practice. The volume now issued standardizes our knowledge of lead metallurgy in a most admirable way. There is nothing to compare with it at the present time. Percy's book, published in 1870, still stands as a monument of exact and careful writing; he fixed no limit on his space, and discussed his subjects in detail and in easy style. When starting his treatise on metallurgy he expected to include the whole subject in one book, and on the publication of the first volume in 1861 he said that though he had found it impossible to finish his subject in one volume he intended to do so in two. Twenty-five years elapsed and three other volumes issued from his pen, but he never attained his object. Thus we see that a book on metallurgy never can be final, and that a too free and detailed discussion, though valuable, is likely to occupy more pages than a general reader desires or a publisher appreciates. A modern book has perforce to discriminate and condense the experience of the day. This is the marked difference between Percy and Mr. Collins, the latter himself a former student at the School of Mines to which Percy gave the prestige of his authority as a scientific investigator.

Mr. H. O. Hofman's book made its appearance in 1893, dealing chiefly with American methods of applying the blast-furnace to lead ores. In our record of other recent books on lead we must not omit the portion of Schnabel's 'Metallurgy' dealing with the subject. All these books, including Mr. Collins' first edition, are now getting old, as metallurgical works go, by reason of many improvements recently introduced, such as pot-roasting and sintering, and the saving of flue-dust, besides developments in the practice of smelting mixed ores. The demand therefore for a new and up-to-date work on lead has been acute for several years and the present volume is most timely.

In the new edition the chapter on sampling has been omitted, and that on assaying and analysis has been compressed and relegated to the end as an 'addendum.' The first two chapters describe the chemistry of lead compounds and the occurrence of lead in commercial ores. Succeeding chapters deal with smelting in reverberatories and ore-hearths; then comes a discussion of the various processes for plain roasting, blast-roasting, and sintering. A large part of the book, namely 200 pages, is devoted to blast-furnace practice; this part has been entirely re-written and it contains much detailed information about current practice in all parts of the world, including the methods of smelting complex ores having a lead base. A useful chapter is that describing the various inventions for catching flue-dust. The third division of the book is devoted to refining. The supplementary chapters, be-

sides that on analysis and assaying, deal with the various processes proposed or used for treating zinc-lead sulphides and with concentration by flotation. Chemical processes for treating mixed sulphides are now of greater academic than practical interest, though there is no knowing when a slight modification of any one of them may not make it spring into sudden importance. Of all of them perhaps Hoepfner's bisulphite process is of greatest interest at the present time, owing to the fact that Hommel and his coadjutors claim to have produced a process of this type that will work in practice. As regards the chapter on flotation, we consider it much the clearest statement of the nature of the various inventions that has yet been published.

We commend this book as one written by a metallurgist of high practical and scientific attainments; who can draw from his own experience and who keeps in close touch with progress in all parts of the world; and who has the power of expressing himself logically and concisely. E. W.

GOLD DREDGING IN CALIFORNIA.—By Lewis F. Aubury. Octavo, paper covers, 320 pp., with many illustrations. Sacramento: California State Mining Bureau.

This book is one of the California State Bulletins. Though it bears the State Mineralogist's name as author, the technical part should be credited to W. B. Winston and Charles Janin, and many of the other parts extracted from standard publications should also have received due acknowledgment.

NIGERIA AND ITS TINFIELDS.—By Albert F. Calvert. Small octavo cloth. 260 pages, with many illustrations. London: Edward Stanford. Price 3s. 6d. For sale by *The Mining Magazine*.

This book gives a history of the development of the territories of the Niger, and in particular of the tin gravel of Northern Nigeria. It contains the full text of the mining regulations issued in 1910, and a great number of photographs illustrative of the manners and customs of the country.

AERIAL OR WIRE ROPE-WAYS.—By A. J. Wallis-Taylor. Cloth 8vo, 250 pp., with many illustrations. London: Crosby Lockwood & Son. Price 7s 6d. For sale by *The Mining Magazine*.

Mr. Wallis-Taylor wrote a book on aerial transport some years ago. Since then many improvements and new applications have been devised, so that the time had arrived for a new book on the subject. He describes various systems and discusses details of standards, ropes, grips, carriers, methods of driving, and he gives a large number of specific examples of the application of this type of transporting plant.

MAP OF CALIFORNIA OILFIELDS.—Compiled by William Forstner, and drawn by R. F. Morton. San Francisco: Holbrook & McGuire. Price £5. For sale by *The Mining Magazine*.

This map is drawn to a scale of one inch to the mile and it includes the Coalinga, Devil's Den, McKittrick, Midway, and Sunset districts. It will prove of value to those interested in California Oil.

AMERICAN CIVIL ENGINEERS' POCKET-BOOK.—Edited by Mansfield Merriman, and twelve collaborators. Morocco, 1380 pp., 944 illustrations, and 495 tables. New York: John Wiley & Sons; London: Chapman & Hall. Price 21s. For sale by *The Mining Magazine*.

This is a new pocket-book for civil engineers; how it will fare in competition with Trautwine remains to be seen.

CURRENT LITERATURE

Pumping at Old Dominion Mine.—In *Mining and Metallurgy* for January 10, E. L. Horvath describes the pumping plant at the Old Dominion mine, near Miami, Florida. The plant consists of two duplex pumps at the 1400 and 1600 levels lift the water to the 1200 ft. level, and four steam driven Nordberg pumps erected at this level raise the water the rest of the way, some of it to the head of the shaft and some to the concentrator. Steam is generated at the surface. The old pumping plant is still retained in order to cope with any sudden influx. Much of the water is used at the concentrator and smelter, and some is to be supplied to the Miami concentrator.

Slime Filter.—*Mining Science* for December 29 describes the 'Portland' filter for slime, of the revolving-drum type. It is made by the Colorado Iron Works Co.

New South Wales Collieries.—At the December meeting of the Association of Mining Electrical Engineers, Ernest Kilburn Scott read a paper on electrical equipments at the collieries in New South Wales.

Drilling Oil Wells.—In the *Mining and Scientific Press* for December 10, W. R. Jewell describes the methods adopted in California for drilling oil-wells.

Suppressing Rock-Drill Dust.—The *South African Mining Journal* for December 24 describes Purser's dust arrester, which has recently been tested with satisfactory results at the East Rand Proprietary Mines. A socket fits over the hole and a spray of water within the socket catches the dust and carries it down a discharge pipe into a bucket.

Mining at Esperanza.—In the *Mexican Mining Journal* for January, Fred MacCoy describes the machinery and plant used for hoisting and hauling ore at the Esperanza mine, El Oro, Mexico.

Cyaniding Silver Ore.—In the *Mexican Mining Journal* for January, Walter M. Brodie describes the modern cyanide practice employed at the silver mines of San Miguel in the Batopilas district, Chihuahua, Mexico.

Taxco, Mexico.—In the *Mexican Mining Journal* for January, Boris Gorow commences a series of articles describing the mineral resources of the Taxco district, Guerrero, Mexico. A company has recently been formed in London to reopen old silver mines in this district under the direction of T. R. Marshall.

Anthracite in a Fissure Lode.—The *Queensland Government Mining Journal* for December quotes a paper read by L. C. Ball before the Royal Society of Queensland on the occurrence of anthracite as vein matter in lodes, where it is associated with blende and galena, at the Silver King mine in the Mended Hill district. The rocks belong to the Silurian age. The author considers that the coal was forced into the veins by earth movements and that it was the agent for precipitating the zinc and lead sulphides from solutions subsequently percolating the fissures.

Progress in Cyanidation.—In the *Engineering and Mining Journal* for January 7th, Philip Argall gives a review of the progress of cyanidation during 1914. It contains many interesting views and comments.

Calumet & Hecla Consolidation.—The *Mining World* (Chicago) for January 14 quotes the propositions for the consolidation of the Tamarack, Osceola, and eight other copper mines, with the Calumet & Hecla, to be submitted to shareholders next month, and discusses the advantages to be gained by this amalgamation.

Mining Methods in Arizona.—In the *Mining and Scientific Press* for December 14 W. L. Loyola describes the methods of mining in the El Estero Moreno copper district, Arizona. These methods include square-set timbering, slicing, and caving.

Dredging Practice.—In the *Mining and Scientific Press* for December 14 W. B. Weston describes a method used by the Isabel Dredging Co., working in Calaveras county, California, for removing clay before the material goes to the recovery plant of the dredges.

Metallurgy of Gold and Silver.—The *Mining and Scientific Press* for January 7 publishes Alfred James's annual review of the progress in the metallurgy of gold and silver, and, in addition, another review of progress of cyanidation in America written by an 'occasional contributor.'

The Empire Drill.—In the *Mining and Scientific Press* for January 7, J. P. Hutchins and N. C. Stines give their experience with the Empire hand-drill used for sampling gravel deposits.

The Burt Slime Filter.—In the *Engineering and Mining Journal* for January 21, Edwin Burt describes the installation of his filters at the El Oro mine, Mexico. These are horizontal tubular filters of the pressure type.

Safety Devices for Hoisting.—In the *Engineering and Mining Journal* for January 21, James J. Smith discusses a number of safety devices for use in connection with hoisting.

Electrolytic Refining of Copper.—In the *Australian Mining Standard* of December 18, H. Schröder gives the first instalment of an article on the purification of the electrolyte used in copper refining. He first describes the old method used at the Lithgow plant of the Great Cobar company and then proceeds to give the results of a new process tried there, insoluble lead anodes being used. Unfortunately the works were closed before the process was fully tested.

Thames Goldfield, New Zealand.—In the *Australian Mining Standard* for December 28 is published an article written for the New Zealand Geological Survey by Colin Fraser on the history of mining in the Thames goldfield, New Zealand.

TRADE CATALOGUES

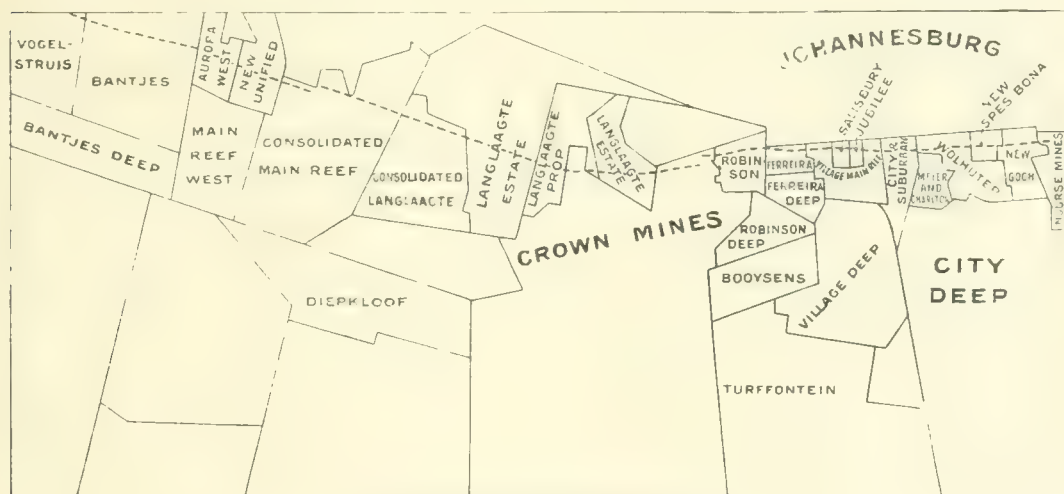
Head, Wrightson & Co., Ltd., of Stockton-on-Tees, have sent us a pamphlet describing the Nissen stamp which they are making in this country. As is well known, this machine is a gravity stamp made on the principle of "one stamp one mortar." Over 600 are at work in various parts of North America, having been adopted at such large mines as the Miami and Bunker Hill & Sullivan. A battery of four stamps is to be tried in competition with those of the ordinary type at City Deep, under the supervision of the inventor.

Holman Brothers, Ltd., Camborne, have sent us a copy of their new catalogue that is to be circulated in the United States. The catalogue describes in detail the construction and performance of the Holman rock-drill. In order to facilitate business in America a company of the same name has been incorporated under the laws of the State of New York. The success of the drill in South Africa has encouraged the firm to embark on this enterprise. The fact that the Holmans have taken this step speaks volumes for their pluck and confidence in their machine. Not only has a high tariff to be overcome but the national prejudice against anything not built in the United States has to be combated. The drill deserves success in America, and we believe it will command it.

COMPANY REPORTS

Wolhuter.—This company was formed in 1887 to acquire claims in the central part of the Rand. Many rearrangements of the property and of deep levels connected therewith were made, and the present relative position is clearly shown in the accompanying map. The control is with S Neumann & Co. Milling was commenced in 1888 and a new battery was built in 1895 and 1896. This plant was destroyed by fire in 1905 and was replaced in 1906 by a mill containing 120 stamps and 2 tube-mills. Two more tube-mills are now in course of erection. The report for the year ended October 31 shows that 397,874 tons of ore was mined, and after 20% had been discarded as waste, 304,360 tons assaying 6'56 dwt. was sent to the battery, where 59,419 oz. gold was recovered. In the cyanide plant 211,850 tons of sand yielded 26,487 oz. and 91,510 tons of slime yielded 6800 oz. The total production was 92,706 oz. realizing £388,084 or 25s. 6d.

it was natural that the mining operations were interfered with considerably and the costs increased. The amount of ore raised was 53,910 tons less than the previous year, and the development was curtailed, being not much more than was required to keep pace with the extraction of ore. The cost of treatment increased by 2s. 8½d. per ton, from 16s. 2½d. to 18s. 11d., though, as the yield per ton increased 2s. 7d. per ton, the actual decrease of profit per ton was only 1½d. Owing to this decrease and to the smaller tonnage crushed, the total profit was less by £80,941. The report by the manager, W. E. C. Mitchell, shows that during the year 454,571 tons of ore was raised and, after the removal of 20% waste, 364,147 tons was sent to the mill. The content of the mill-feed was 11'7 dwt., and the recovery by amalgamation was 141,206 oz., or 7'75 dwt. per ton. In the cyanide plant, 364,487 tons yielded 66,874 oz. or 3'67 dwt. per ton, and the residue assayed 0'5 dwt. The total yield was 208,080 oz., worth £873,337, and the working cost was £334,400, leaving



PART OF THE WITWATERSRAND

per ton. The profit was £122,554 or 8s. per ton. The developments have been decidedly satisfactory during the year and on a re-estimation the reserve at October 31 was found to be 753,679 tons averaging 6'45 dwt. The company has not been a payer of large dividends. Distributions were made in 1894, 1897, and 1898, but it was only during the year under review that payments were resumed. Dividends were then declared of 5% absorbing £43,000 on account of the profits of the year ended October 31, 1909, and more recently 10% absorbing £86,000 has been paid on account of the year ended October 31, 1910.

Ferreira Deep.—This mine has suffered during the past year from movements of the hanging wall, owing to the pillars not being sufficiently wide and strong to support the superincumbent strata. At first, attempts were made to strengthen the supports, especially near the main haulage ways, by packing with waste, but as this was not sufficient to meet requirements, it was deemed desirable to resort to close timbering. Subsequently, in June last, in order to devise a means for permanent support, experiments were made with sand-filling. The report for the year ended September 30 shows that up to the end of the period under review 57,587 tons of tailing had been deposited in the mine in this way. Under the circumstances above detailed,

a profit of £528,937. The yield per ton milled was 48s., the cost 18s. 11d., and the profit 29s. 1d. The amount distributed as dividend was £500,500, being at the rate of 55%. During the year, 7103 ft. of development work was done, and 510,804 tons added to the reserve, which on September 30 stood at 1,779,328 tons, averaging 9'6 dwt. Since the formation of the company in 1898, the amount of gold won has been worth £5,363,467, and the dividends have totalled £2,570,750.

Van Roi.—This company was formed in 1908, as an off-shoot of the Le Roi No. 2 Company, for the purpose of developing the Vancouver group of silver-lead-zinc claims in the Slokan district of British Columbia. The capital is £34,500, divided into 30,000 preference shares of £1 each and 90,000 ordinary shares of 1s. each. The purchase price was £20,000 cash paid to the local owners, and 60,000 ordinary shares paid to the Le Roi No. 2 Company. Alexander Hill & Stewart are the consulting engineers. Much development work has been done, and an adit driven through the hill from the Mountain Boomer claim in order to facilitate transport to the new mill in Granite Creek. The company when acquiring the property continued to treat the ore at the Wakefield mill of which they obtained a lease. This arrangement terminated on August

the last year, and since then mining has been in progress, and is expected to be completed at the end of the year. The new mill is now under construction, and the company has been working on the property. By the time this notice appears it is probable that this work will be completed, and the mill will be in operation. The new mill has an estimated capacity of 4000 tons per month. The report for the half-year ended September 30 shows that, during the 10½ months to August 15, the leased mill treated 32,313 tons of ore assaying 3% lead, 7.4% zinc, and 13.3 oz. silver, and produced 1452 tons of lead concentrate assaying 64% lead, 10½% zinc, and 148 oz. silver, and 1458 tons of zinc concentrate assaying 47% zinc, 1.7% lead, and 47½ oz. silver. The average assay of the tailing was 4.95 oz. silver, 0.04% lead, and 5.31% zinc. It will be seen from these figures that a remarkably good recovery of the lead is made, namely 99%, and that only 35% of the zinc is saved; the recovery of silver is 66%, which shows that the metal is equally distributed throughout the sulphides. The company is under the disadvantage of having to ship its zinc concentrate to the United States, and consequently to pay an import duty as well as the freight, the two items amounting together to £4 per ton. On the other hand the company receives a bounty on its production of lead from the Canadian government. The total income for the year was £34,872 and the profit was £3927. Development work during the year has disclosed valuable ore, especially in the Beryl vein which runs parallel to the Main vein. The amount of ore reserve in the vein on September 30 was estimated at 16,035 tons, averaging 12½% zinc, 7% lead, and 15½ oz. silver.

Amalgamated Zinc (De Bavay's).—This company was formed in Melbourne in September 1909 for the purpose of expanding the operations of the De Bavay Treatment Co., which owned the De Bavay flotation process for producing zinc concentrate from Broken Hill tailing. We gave particulars of the company in our issue of November 1909, and we published an abstract of the results of the first six months' work in our issue of August 1910. The report now to hand covers the half-year ended September 30, and gives additional information to November 30. During this period 160,957 tons of tailing was treated, producing 47,448 tons of zinc concentrate, assaying 48% zinc, 7.12% lead, and 7.28 oz. silver, and 767½ tons of lead concentrate, assaying 54% lead, 11.8% zinc, and 23 oz. silver. The second unit of the new plant commenced work in August, the old mill being at the same time abandoned; and the third new unit went into commission at the end of October. During the first part of the half-year the output came from the first new unit and the old mill, and during the latter part from the two new units; the third and final new unit did not come into operation until after the expiry of the period under review. When the company was formed, £150,000 was estimated as the expenditure required for erecting the new plant. Owing partly to the difficulty of obtaining efficient labour, this estimate has been exceeded, and the figure will eventually be found to be about £190,000. Some of the extra expenditure is due to improved methods introduced since the company was started, the increased capacity thereby gained having an important influence on profits. During the half-year the income from the sale of concentrate was £135,057 and the profit was £43,390. Out of this £10,000 has been written off for depreciation and £25,000 has been placed to reserve. The half-year commenced with £28,816 in hand, and the final balance on September 30 was £37,206. Since the close of the year a dividend of 1s. per share has been dis-

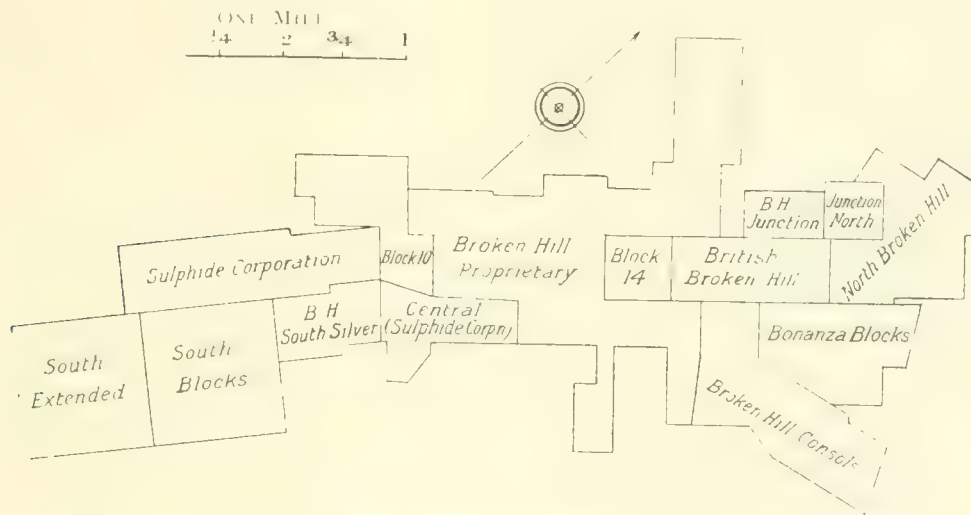
tributed, and the intention is to declare dividends quarterly. During the half-year, the options on the remaining 122,500 shares have been exercised, so the whole of the capital, £500,000, has now been issued. The company will have a dump of material to treat and valuable contracts for the current output of the Broken Hill South, North Broken Hill, and Block 10 mine. The report mentions that the company is endeavouring to have a suit brought by Minerals Separation for infringement of patents.

Minerals Separation. The company owns the Sulman-Picard-Ballot-Hoover flotation patents for the concentration of sulphide ores. The plants are situated at the Sulphide Corporation mine, Broken Hill; one plant, which is owned by the Corporation, treats current zinc tailing at a royalty, and the other, belonging to the Minerals Separation company, has been treating the old zinc tailing dumps of the Corporation. Particulars of treatment of current tailing have been given in our abstract of the Sulphide Corporation report. During 1909 the dump plant treated 193,842 tons and produced 68,552 tons of concentrate, assaying 46.8% zinc, 8.9% lead, and 14 oz. silver, at a cost of 7s. 9d. per ton. During the 9 months, January to September 1910, the amount treated was 179,218 tons, yielding 62,775 tons of concentrate, assaying 46.9% zinc, 9.4% lead, and 14.2 oz. silver, at a cost of 7s. 6d. per ton. During the last of the three quarters the cost had been reduced to 6s. 8d. per ton. The Sulphide Corporation dump was exhausted on October 1. The whole dump contained 481,859 tons, for which Minerals Separation had paid £177,686 in cash. The plant cost £25,903 and the treatment cost £142,722. The concentrate produced sold for £492,955 and, after paying brokers' commissions, etc., the net profit was £120,788. Since October 1 the plant has been working on lower grade tailing, paying no purchase price to the Sulphide Corporation, but sharing the profit equally. The company is erecting plant at the Great Fitzroy copper mine in Queensland, also at a copper mine in New South Wales, and at a zinc-lead mine in Finland. Arrangements have been made to work the process actively in North America by means of a subsidiary syndicate, for whom E. H. Nutter and James Hyde will act as technical advisers. An interesting improvement in the process not before recorded is one whereby the first flotation produces a zinc concentrate high in lead and the second a zinc concentrate low in lead. The advantage of this is that in the subsequent dressing out of lead on Wilfleys much less material has to be sent over the tables than when one uniform product is made. Unfortunately the company is still in the midst of law suits. Two have been commenced, one against the Zinc Corporation for breach of contract and one against the Amalgamated Zinc (De Bavay's) for infringement of patents. Actions in which the company's process is implicated have been taken against the Sulphide Corporation by the Elmore company and by the Potter company. Under the circumstances the company is not distributing any dividend but conserving the large cash profits it has made. The consulting engineer, Theodore J. Hoover, ceased his active connection with the company on December 31.

Broken Hill Block 14.—As we have recorded in previous notices, the work at this mine is restricted to the winning of carbonate ore left behind in the upper levels. During the half-year ended September 30 last, covered by the report just issued, 12,420 tons was raised averaging 31% lead and 14½ oz. silver, as compared with 12,876 tons averaging 32% lead and 16 4

oz. silver during the previous six months. As regards further supplies, F. Voss Smith, the manager, finds it impossible to give any estimate; though few solid bodies of ore are left, prospecting and reopening of old stopes is continually bringing to light smaller bodies of ore that had been left behind. It is probable that the mine will continue to yield for some time yet. Little has been done in mining the sulphides, the reserve of which amounts to 220,000 tons averaging 12% lead, 9% zinc, and 8½ oz. silver. About 500 tons has been raised for the benefit of the Murex Company, which has erected a plant on its own account for the purpose of testing the process. It has proved successful in obtaining a mixed sulphide concentrate from the crude ore, but the necessary plant for the second part of the process, that is, separating the mixed sulphides, is not yet in working order. During the half-year the production of carbonate ore was sold to the Proprietary Co. for £24,891 and the net profit was £5278.

slime was not amenable to the treatment. It seemed probable that the plant would have to be greatly enlarged in order to make a profit. The acting manager, J. N. F. Armstrong, was of opinion that the recovery could be improved with practice, but the board decided to revert to the old custom and to sell the tailing to the De Bavay Co. One reason for encouraging them to do this was that they had no satisfactory contract for the disposal of zinc concentrate, whereas the De Bavay Company had. During the year the lead concentrate was sold for £46,509, and the credit for zinc concentrate sold but not paid for, and for other small items of income, brought the total revenue to £56,490. On the other side of the accounts the working expenditure came to £60,481 so that a loss of £3991 was made. Out of the tailing reserve account of £22,991 carried forward from the previous half-year it was possible for the company to distribute £15,000 as dividend, being at the rate of 3s. per £10 share. As



THE BROKEN HILL MINES.

Broken Hill Block 10.—In our review of the half-year ended March 31, 1910, in our issue of September last, we recorded that work at this mine had been suspended for three months owing to the coal strike. The report for the subsequent half-year ended September 30 just issued shows that work was resumed on April 18 and has continued uninterruptedly since. During the period 53,558 tons of sulphide ore was mined and 53,025 tons sent to the lead plant. This ore assayed 12.4% lead, 13.9% zinc, and 12½ oz. silver. The lead concentrate produced amounted to 7608 tons assaying 59½% lead, 7.6% zinc, and 34 oz. silver. As recorded in our September issue, arrangements had been made to treat the zinc tailing by the Elmore process, instead of selling it to the Zinc Corporation and the Amalgamated Zinc (De Bavay's) Co., and 4 units capable of treating 800 tons per week commenced operations at the end of June. The results obtained were not considered satisfactory and the plant was closed at the end of September. During the time it was running, 3548 tons of zinc tailing was treated assaying 17.58% zinc, 3.77% lead, and 7.84 oz. silver, and the yield of concentrate was 964½ tons assaying 43.63% zinc, 9.6% lead, and 20.91 oz. silver. The recovery was 67% of the zinc, 69% of the lead, and 72½% of the silver. The performance of the plant varied, and the

regards the developments in the mine, the main shaft is now down 1715 ft. and a new level is being opened at this depth. Work at the 1115 ft. and 1215 ft. levels is being continued and is promising, but sufficient has not yet been done to warrant an exact estimate. The report does not contain much information of importance relating to the other two properties recently acquired, the news from the Comstock at Zeehan, Tasmania, being in fact rather discouraging so far.

Broken Hill South Extended.—This company was registered in London in 1907, and is the second reconstruction of the Australian Broken Hill Consols which was originally formed in 1888. Except for a small dividend in 1891 the shareholders have received no return. The property consists of Blocks 52, 53, 89, and 90, the work being confined so far to the first named, and adjoins on the south the mine of the Broken Hill South Blocks. Recently a new main shaft has been sunk with the idea of exploring at greater depth. At 930 ft. the mineralization was so promising that diamond-drilling was undertaken in both eastern and western directions, and the former disclosed three bodies of zinc-lead sulphides, so that a crosscut was immediately commenced. The report for the year ended June 30 contains additional information brought down to November. T. G. Sweet, the

the middle of November 100 ft. has been driven, the whole length in ore. The assays show a content of zinc varying from 20 to 30%, of lead 14 to 20%, and of silver 3 to 4 oz. The prospects of opening out large amounts of profitable ore are encouraging, and work is being concentrated on the 930 ft. level instead of sinking the shaft any deeper.

Colombian Mining & Exploration.—This company was formed in 1905 to acquire a large tract of territory in the districts of Supia and Marmato, Colombia, containing gold and silver mines and prospects. Work has been chiefly centred on the Marmato Hill mine which had previously yielded profits to other owners. The properties were reported on by C. Olden, L. Parker, and H. H. Knox, and the first named was made manager. As progress was not satisfactory, Arthur Wilkinson was sent out a year ago to examine and report. He found that the developments were not being conducted on the right lines, and he recommended that T. L. Dawson should be appointed manager at the termination of Mr. Olden's engagement in January of last year. Mr. Wilkinson's report shows that the average content of the ore is 8 dwt, and that 5000 tons per month could be mined. He considers that additional development is required at the Marmato Hill mine and that new treatment plant including fine grinding and cyanidation will have to be provided. Already £50,000 in cash has been spent to no purpose, and Mr. Wilkinson is of opinion that another sum of like amount will have to be provided to put the company on a paying basis. He estimates the cost per ton at 15s., or 20s. if further prospecting is undertaken. The district is far from civilization, and communications are difficult. The issued capital of the company is £100,000, of which £11,000 was subscribed as working capital.

Aporoma Goldfields.—This company is the expansion of the Aporoma Exploration Syndicate and has been formed with a capital of £300,000 to acquire and work gold gravel deposits at Aporoma in the province of Sandia, Peru. Merricks, Crane & Co. are the managers and engineers. They report that the deposit has an area of 1277 acres, being 3700 yards long and from 1500 to 1800 yards wide, with a depth varying from 50 to 400 ft. The average content is estimated at 10½ d. per cu. yd. Sluicing plant is now being erected for the treatment of 5000 cu. yd. per day, and a duplication is contemplated. The gravel was worked many years ago by the natives and by Spaniards, and their ditches in smooth slate rock are still available. The engineers estimate the cost of treatment at 2½ d. per cu. yd., so that the profit will be 8 d. per cu. yd., making a total profit of £1,648,000. Work will probably commence in October next.

Mount Lyell Comstock.—This company was formed in England in 1898 to acquire from local owners a copper property adjoining the big Mount Lyell mine in Tasmania. On reconstruction in 1907, Alexander Hill & Stewart were appointed managers. Hitherto the ore discovered has been low grade and highly silicious, and treatment at a profit has been impossible. The report now issued covers the year ended September 30, and shows that development and prospecting work has been continued throughout the year with satisfactory results. It is estimated that 300,000 tons averaging 2·8% copper is available in existing levels, and that another 300,000 tons varying from 2·8 to 4·5% copper

is available in other parts. In addition to these resources there are strong indications of the ore continuing laterally and in depth. The outlook is encouraging, seeing that the recently developed ore is of a better grade than that in the upper levels. The metallurgical processes to be used in the Elmore process have been conducted throughout the year. The results show that freshly broken ore from the lower levels is amenable to this treatment, but it is not so certain that the ore that has been exposed for a long time to the atmosphere in the upper levels will give good results. Some of the sulphide reserve is oxidized, thus becoming untreatable, and in other parts of the older ore reserve the gangue is so much decomposed as to form a clinging slime. The engineers recommend the provision of an Elmore plant to treat 250 tons per day. To provide the necessary funds, the directors intend to place before shareholders at an early date a proposition involving the issue of preference shares.

Oonah Mines.—This company was formed, as a subsidiary of the Mount Lyell Comstock Co., in April 1908, to acquire property near Zeehan, Tasmania. In earlier days the property had yielded silver-lead ores, but more recently lodes containing stannite, that is sulphide of tin and copper, have been worked. In our issue of February last year we described at some length the metallurgical processes tried for the treatment of this ore. The process eventually recommended by Alexander Hill & Stewart, the managers, was smelting in a blast-furnace and producing a copper-silver matte and an argenteiferous copper-tin alloy with the subsequent refining of the matte in a reverberatory. At the time of writing last year we stated that pot-roasting was being adopted as a preliminary to the blast-furnace treatment. The report now issued covers the financial year ended June 30 last and additional particulars are given to January 11. Sintering operations were commenced in October last, but in December it was found that the rate of operation of the process on the pots was not nearly sufficient to keep up with the blast-furnace. Operations were therefore suspended. Unfortunately the capital of the company is exhausted, and the future is uncertain.

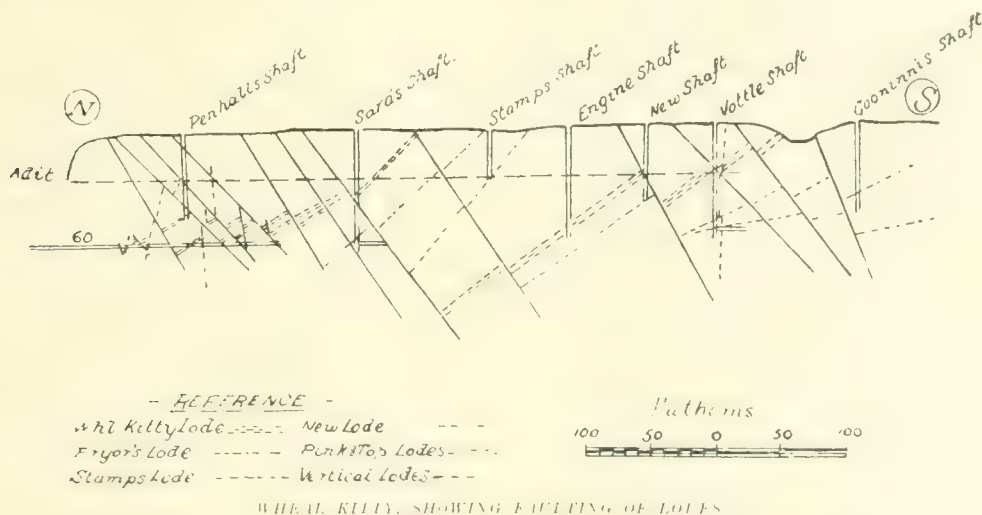
Associated Northern Blocks.—This company was formed in 1899 to acquire the Iron Duke and adjoining leases at the northern end of the Kalgoorlie gold mining district, Western Australia. The control and management is the same as that of the Associated Gold Mines. From 1901 to 1910 satisfactory profits were made, but for the last two years the ore reserves have gradually been exhausted, and the directors have had to turn their attention to other properties. The report now issued covers the year ended September 30. During this time 32,120 tons of ore was mined and milled yielding gold worth £50,841; in addition 7012 tons of tributors' and purchased ore was treated. The working profit was £17,500, and after administration, taxes, and exploration expenses had been paid, the net profit was £7577. George M. Roberts, the manager, reports that the reserve of ore is not entirely exhausted, and that enough is left to keep the mill going for a year. The report contains an account by W. E. Simpson on the El Refugio group of gold and silver mines recently acquired by the company at Salinas, in the State of Zacatecas, Mexico, not far away from the State of San Luis Potosi. These mines were extensively worked in years gone by and the richer parts exhausted. Preliminary sampling and cross-cutting revealed the presence of large bodies of ore that can be profitably treated by modern methods of mining and metallurgy, so the option was exercised in July last. The ore

averages 35s. to 40s. per ton, 60% of the value being in gold and the rest in silver; there is no refractory constituent and the metallurgical process will be simple. The old main shaft is 400 ft. deep, and Mr. Simpson is actively developing on three levels at 150 ft., 250 ft., and 380 ft. The mine is 8 miles from the railway. The country is entirely destitute of timber and coal is very expensive. It is expected that electrical power will be available in the near future, as the hydro-electric service utilizing falls near Lake Chapala intended for the town of San Luis Potosi will pass comparatively near the mines, and the power company is ready to build a branch line wherever inducement offers. Mr. Simpson's report is cheerful reading and, as the purchase price of the new property is small, the South Blocks company seems in a fair way to a rejuvenation.

Wheal Kitty & Penhalls.—The half-yearly report of this company operating the Wheal Kitty mine at St. Agnes, Cornwall, covers the second half of 1910, and shows that during this time 7636 tons of ore was

4 tons raised. The total cost, including royalties, administration, and taxes, was 24s. 6d. per ton milled. Arthur C. Claudet has recently joined the board of directors. We give herewith a vertical section of the workings from north to south. It shows the amount of faulting characteristic of St. Agnes district. Sara's shaft is being sunk to cut the Wheal Kitty lode. Most of the ore at present mined comes from the vertical lodes in the Vottle and Gooninnis parts of the property. In his speech at the shareholders' meeting, J. H. Collins, the chairman, gave a general review of the results obtained during the four years that the company has been working. During this time 800 tons of tin concentrate has been produced, practically all from above the 30 fm. level, showing in a practical way the correctness of his contention that many old mines still contain large amounts of tin at shallow levels. As regards deeper sinking at Wheal Kitty he expressed every confidence in finding even richer deposits at depth.

Cornwall Tailings.—A statement in the nature of a



raised, and 110 tons concentrate produced. The receipts were £11,091 or £100 per ton, and the average yield was 32 3 lb. per ton. This yield compared with 37 lb. and 43 lb. in the two preceding half-years, and the decrease is intentional on the part of the managers, J. H. Collins & Sons, who take the opportunity of winning low-grade ore at a profit during periods of high prices. The cost of mining, including all development, was £7938, and management, taxes, and royalties accounted for £1436. The balance of profit was £1789, out of which £616 has been written off for depreciation of plant and £936 off the expense of Sara's shaft. The dividend for the half-year is at the rate of 10% per annum on the 9887 preference shares (4s. paid) and 5% per annum on the 54,257 ordinary shares (of 10s. each), the total distribution being £783. Six months ago in our review of progress at this mine, we announced that the directors had decided to offer 14,000 preference shares of 10s. each in order to provide funds for hastening the sinking of Sara's shaft. As noted above 9887 shares have been taken up, and it is of interest to note that the three 'lords' have between them either acquired or have applied for 2500 of these shares. The amount of development work done during the half-year was 1914 ft. or 1 ft. for every

prospectus has been issued by the directors. The company was registered in January a year ago for the purpose of acquiring and re-treating the dump at Carn Brea & Tincroft. The financial supporters of the scheme are a group well known in connection with Australian mining, the names including Baillieu, Robinson, Clark, and Lempriere. Arthur Richards is engineer and managing director. Most of the tailing at the Camborne mines is washed down the Red River. Owing to lack of water, all of the tailing at Carn Brea & Tincroft could not be so removed, and much of it has been stacked on the surface for the last sixty years. The new company sampled the dumps by boring, and the amount of material was estimated at over one million tons. The chemical assay gave an average content of 17 lb. metallic tin per ton. A concentrating plant was erected last spring and during the six months ended December 31, 24,000 tons of material was treated, yielding 93 tons of black tin, which sold for £6901. This recovery is 8'68 lb. black tin per ton, which is only 30% of the content, according to the chemical assay. The price received per ton of dump material was 5s. 9d. and the cost, including purchase price, was 3s. 1½d. The total profit was £3144. Additional machinery is now being erected, and by next

pected that the extraction will be gradually increased.

17 lb. of metallic tin per ton a high figure for a dump, was stacked 30 to 60 years ago when the content of the ore at present being mined. When this rich tailing was placed on the dump it was considered waste and there was no idea of storing it for future treatment. It is only the scarcity of water that prevented its dispersion long ago. This company constitutes one of the most interesting ventures in Cornwall at the present day, and the satisfactory results so far obtained are a matter for congratulation.

Sheba Gold.—This company was originally formed in 1884 to acquire gold mines in the Barberton district of the Transvaal. During the years 1891 to 1898 satisfactory profits were made, but since then shareholders have received nothing. In 1904 additional capital was raised by a reconstruction scheme. The control is in the hands of Lewis & Marks, C. B. Kingston is consulting engineer, and Howard Hill is manager. The company owns a great many properties, of which the Zwarzkopje is receiving chief attention at present; three others are being worked by the company and six by tributors. The report for the year ended June 30 last shows that the mill treated only 40,750 tons of ore, as compared with 96,160 tons the year before; the assay value was 8.88 dwt. per ton and the extraction 78%, as compared with 6 dwt. and 87%, and the recovery was 14,121 oz., as compared with 25,944 oz. Some of the gold is obtained by amalgamation and some is obtained by cyaniding roasted concentrate. The income for the year was £62,871, and the expenditure £61,020, leaving a profit of £1,851. In spite of the decreased output the financial position of the company is better now than a year ago. The manager's report shows that since the end of the company's financial year the developments at several of the properties have proved promising. The capital of the company is £1,078,954, and the prospect of ever paying an adequate dividend on this sum is remote.

Gwalia Consolidated.—This company was formed in 1898 to acquire claims adjoining the Sons of Gwalia, Western Australia. In 1902 operations were suspended, and the Lady Violet gold mining property at Wiluna in the Lake Way district of East Murchison was purchased. Subsequently the mine and plant of the Lake Way Goldfields Co. were acquired. The Lady Violet is being worked at present with 30 stamps and cyanide plant. Bewick, Moreing & Co. are the general managers in Western Australia, and Hooper, Speak & Feilding are the consulting engineers. During the year ended June 30 last, the mill crushed 63,338 tons of ore having an average value of 35s. 3d. per ton, and the cyanide plant treated 13,400 tons of sand and 45,087 tons of slime. The total yield of gold was £80,026, or 25s. 3d. per ton, being an extraction of 78%. The profit was £11,149, which with the balance brought forward from the previous year, made a credit balance of £24,683. The directors have written off £17,521 for depreciation, leaving £7,161 to be carried forward. No dividends have yet been paid. As can be judged from the above figures, the ore is difficult to treat, and the managers are troubled with the problem of beneficiating refractory gold ore. W. J. Loring has recently paid a visit to the mine to investigate and report. Parcels of ore have also been sent to various

owners of special processes. The indications at present are that roasting may solve the difficulty. The ore is estimated to contain 50% of gold, and a large amount of ore averaging 25s. which however is not at the present time profitable. The future of the company depends on whether a suitable process can be evolved for the treatment of low grade refractory ore on a large scale.

South Kalgurli Gold. This mine is situated to the south of the Kalgurli mine, to the west of Great Boulder Perseverance, and to the east of the Hainault. John Morgan is manager. The company was formed in 1895 and production started in 1900. As with many of its neighbours, trouble was experienced in the treatment of the sulphides and tellurides and the extraction plant was altered several times. In 1905 roasting, fine grinding, and cyaniding were adopted and profits then commenced. The report for the year ended September 30 shows that 140,100 tons of ore yielded 34,640 oz. gold worth £145,040, and that the profit was £20,858 out of which £20,000 has been paid as dividend being at the rate of 10%. Mr. Morgan describes the development work done during the year on the Lake View, Perseverance, and intermediate lodes. The workings are down 1500 ft. and at this level the results of development have been somewhat disappointing. The reserve of ore on September 30 was estimated at 171,877 tons averaging 6.3 dwt., and there was 90,930 tons described as probable, averaging 5.6 dwt. To test the mine further in depth, the Main shaft on the Lake View lode is now being sunk to 1800 ft.

Le Roi No. 2.—This company was one of the old Whitaker Wright flotations and dates from 1900. It was formed to work the Josie, Poorman, Annie, and adjoining claims at Rossland, British Columbia. Subsequently the management was placed in the hands of Alexander Hill & Stewart who have been successful in conducting operations at a profit under anxious conditions of mining. The report for the year ended September 30 shows that the Josie mines continue to be productive and that diamond drilling operations have disclosed fairly promising veins. During the year 73,760 tons was mined of which 26,431 tons was rejected, 29,776 tons was shipping ore, and 17,553 tons concentrating ore. The shipping ore contained 17½ dwt. gold, ½ oz. silver and 1.63% copper per ton, and the gross value was \$666,315 or \$22.38 per ton. The concentrator treated 17,265 tons averaging 2½ dwt. gold, ½ oz. silver, and 0.55% copper, producing 1368 tons of concentrate averaging 1.3 oz. gold, ¾ oz. silver, and 1½% copper. The receipts from the sale of the ore and concentrate were £105,268; and the profit was £37,702, out of which £36,000 has been distributed as dividend being at the rate of 6% on the capital of £600,000. Alexander Hill & Stewart report that the position of the mine as to future developments is about the same, and that recent drilling and development have disclosed a new vein which is exceedingly promising.

Magadi Soda.—This company has been formed for the purpose of acquiring a deposit of natural soda at Lake Magadi, British East Africa. The deposit consists almost entirely of carbonate and bicarbonate of soda, there being no trace of sulphate which is a usual constituent of natural soda deposits. According to Arthur Trobridge 200 million tons is known to exist, and as the soda is extracted other soda is deposited in its place. A. Gordon Salomon reports in high terms of the value of the soda in competition with the usual articles of commerce. The promoters are M. Samuel & Sons, of Sheil oil fame, and Krupps and Wernher Beit are interested.

face plant consists of 20 stamps erected and another 20 ready on the spot, together with concentrating machinery. It is to be hoped that shareholders will persevere in their venture.

South Crofty.—This is one of the successful Cornish tin mines, reopened during the boom four years ago. It is the near neighbour of Dolcoath and Carn Brea & Tincroft. The veins contain much wolfram and arsenic. The mine was acquired by the present company in 1906 by the Allen-Meyerstein group in London. The capital is £50,000 in £1 shares of which the previous owners received 20,000 shares carrying a liability of 5s. per share, and on the formation of the company the promoters procured subscriptions for 20,000 at par. A short time afterward the remaining 10,000 shares were sold at £4 each. The total cash funds were therefore £65,000. A new shaft has been sunk and much development work has been done; modern dressing plant has also been provided. The company first made profits in 1909 when 15% was



distributed. The report now issued covers the year 1910, and shows that the dividend is to be the same as in 1909. During 1910 the amount of ore raised was 60,916 tons and the production was as follows: 630 tons tin concentrate, value £56,561; 126 tons wolfram concentrate, value £13,579; and crude arsenic 736 tons, value £7664. The total receipts including sundries were £77,315, or 25s. 6d. per ton, and the costs £62,500. An allowance of £2968 was made for depreciation, £5000 has been placed to reserve, and £7500 has been distributed as dividend. During the year improvements have been made in the arsenic refining plant, and the defects which gave rise to a law suit for damages have been remedied. The new main shaft is completed to the 1350 ft. level, and is now being sunk a further 120 ft. During the year 4697 ft. of development work has been done, and the ore disclosed has averaged a rather higher content than during the last two years. The report by the manager, Josiah

developments at the mine.

Exploration Company.—The report of this company, which was formed in 1909, states that its investments stand at £504,621. The company owns real estate in Johannesburg, and in the Tomboy, El Oro, and Suchi Timber companies. The subsidiary company called the Exploration Company of England is conducting operations in Mexico, has been actively engaged in investigating new properties; the capital of which is £1,000,000, of which the Exploration Co. has all of which are held by the Exploration Co. The Buena Tierra mine in Chihuahua has been bought by the Mexican Co.; it is fully equipped and is earning a profit. In order to provide funds for the purchase, the Exploration Co. advanced £139,878. Whether the Mexican Co. is to hold the mine as its own property, or to form a separate company to work it, has not yet been decided. The Mexican Co. has also purchased the Santa Rosa mine in Zacatecas, and has formed a separate company to work it, retaining 60% of the share capital. A metallurgical plant is now in course of erection. The Mexican Co. holds working options on other properties in Mexico and is conducting development work on them.

Derbyshire Minerals.—This company has been formed for the purpose of reopening lead mines in Derbyshire. Lead has been worked in the Derbyshire limestone from time immemorial; but in modern times, the old laws still extant, the troubles with owners of river rights, and the cost of transport of ore to smelters, have combined to restrict operations. There are several lead-mining companies making a fair production in Derbyshire, but as they are owned privately, no information is available as to their methods of mining and treatment. The present company has a capital of £45,000, divided into 44,000 cumulative preference shares of £1 each, entitled to 6% dividend, and 20,000 deferred shares of 1s. each. The purchase price is £18,500, payable as to £5000 in preference shares, the whole of the deferred shares, and the balance in cash or preference shares. The prospectus offers 29,000 preference shares for subscription. A number of properties are to be acquired in several parts of Derbyshire. The most interesting are the old mines in Smalldale and Pindale near Castleton; these are no doubt the mines referred to by Sir Walter Scott in 'Peveril of the Peak,' in which story he used the classical expression 'Now, you drift drivers!' thus accentuating the difference between the words 'drift' and 'drive.' Other properties acquired are farther to the east and south, including some on Longstone Edge and others at Eyam and Stony Middleton. As is well known, these Derbyshire lead mines contain large amounts of fluor spar, which until recent years was a drug on the market. Owing to the great demand for fluor spar from steel makers, who use it in the basic open-hearth furnace for the purpose of prolonging fluidity, many of these lead mines in Derbyshire have been reopened and the old dumps exploited. In fact this industry has been most profitable during the last few years. As regards the mines acquired by the present company, we have no definite information as to their value. L. H. Wilkins, of Finsbury Pavement House, is the consulting engineer.

De Beers.—The report of this diamond mining company, operating at Kimberley, Cape Colony, for the

twelve months ended June 30, 1910, shows that the period of anxiety due to the fall in the sale of diamonds has passed away. The diamond account, including sale of diamonds during the year and the stock on hand at cost price, amounted to £5,414,395, an increase of £1,000,000 on the previous year. It has been possible to distribute £800,000 as dividend on the preference shares and £1,000,000 on the ordinary shares, being at the rate of 40% in both cases. It is notable also that owing to the substitution of mechanical disintegration for weathering, it has been possible to do much less mining and to decrease the amount of blue ground in stock. During the year this decrease has been so great as to release £804,699. Owing to the increased sales and the decreased value of the blue ground on the floors, it has been possible to introduce a scheme for the redemption of the outstanding debentures, the amount £1,216,126 being redeemed in January of this year at 5% premium. During the year the Dutoitspan mine has been reopened, and this and the Kimberley, Wesselton, and Bultfontein are now being actively worked; in addition the blue ground on the floors at the De Beers mine now closed is still being washed. The total amount of ground hoisted during the year was 5,111,524 loads as compared with 3,557,975 loads the year before; 6,684,156 loads was washed, as compared with 4,774,172 loads. The average yield was 0.23 carat per load at the Dutoitspan floors, 0.32 at Wesselton, 0.37 at Bultfontein, and 0.38 at the De Beers and Kimberley.

Silverton Mines.—In our issue of November 1909 we gave particulars of this company which was formed to acquire from M. S. Davys his interests in several lead-zinc-silver properties near Silverton, in the Slocan district of British Columbia. Mr. Davys is known in England as having been the lessee of the Hall Mines at Nelson, that once were prominently before the British public. The interests acquired comprised the leases of the Hewitt and Lorna Doone mines adjoining the property of the Van Roi Co., of which Mr. Davys was the vendor, and also options on the Tiger group of mines, and on the lease of the Wakefield concentrating plant which was sublet to the Van Roi Co. The report now issued covers the year from June 15, 1909, to September 30, 1910. Most of the time has been occupied by development work at the Hewitt and Lorna Doone mines. The veins so far are higher in zinc than lead, and carry comparatively large amounts of silver. Hand picked ore to the amount of 210 tons was sent to the smelter, yielding \$11,323 in cash; the metallic content or assay is not given. Much ore is being accumulated awaiting the commencement of milling in the early spring. The Wakefield mill was sub-leased to the Van Roi Co., but as stated in our notice of the latter company on another page, the lease has expired. The lease of the mill to the Silverton Mines is still in existence; whether the mill is to be used by the Silverton Mines is not stated in the report.

Filani (Nigeria) Tin Mining.—This company has been formed with a capital of £80,000 for the purpose of acquiring the prospecting rights over 16 square miles of tin-bearing country in the Bauchi district, Northern Nigeria, and situated about 40 miles north of Naraguta. Lake & Currie are the consulting engineers, and the report was made for them by Henry A. Judd, who conducted many examinations on their behalf. The properties acquired are divided into three groups, Saiga, Rigah, and Rishi. Mr. Judd considers the indications and the results of trial examinations sufficient to warrant working by sluicing.

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Scientia non habet inimicum nisi ignorantem.

T. A. RICKARD, Editor.

EDGAR RICKARD, Business Manager.

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REVIEW OF MINING

INTRODUCTORY.—The market for mining shares was not gay during February, the effects of several fiascos having dampened the enthusiasm of the public. Dealings have been mainly professional. Neither the Gold Fields new issue of capital nor the Chartered meeting evoked enthusiasm. The efforts to boost various shares have been too palpable. Part of the weakness in our mining market is attributed to liquidation from Paris due to a boom in Russian industries, followed by a reaction, which compelled realization in other securities, including mines. The revival in Home railways and in rubber shares has also diverted some support, but to our mind the two factors that have checked animation are the Waihi, Golden Horse-Shoe, Mexico Mines, and other disappointments, together with the manifest effort to lift Rhodesian and other shares after they have risen far beyond their merits. The discounting of the future development of Rhodesians and West Africans has had the effect of eliminating any reasonable rise in the quotations when anticipations regarding the mines themselves have been finally confirmed. To borrow on the future may be a cheerful process for the moment but it exhausts the treasury of hope and ends in bringing speculation to bedrock. Another wet blanket took the form of a rumour that a disagreement had developed between two of the big groups from whom co-operation had been expected in Rhodesian affairs. A reason for the slackness of the Kaffir market in particular was alleged to be the diversion of energy by the Central Mining and Investment Corporation, or Wernher, Beit & Co., to the Magadi Soda enterprise. The accuracy of a rumour does not measure its effect on quotations, as, for example, in the case of Mexican rails and mines, both of which have suffered

from sensational rumours, instigated by the sudden mobilization of American troops in Texas.

TRANSVAAL.—The share market has been weak, although fluctuations in the labour supply at Johannesburg are favourable, the report of the Chamber showing that the numbers increased by 6145 in February, on top of an addition of 4666 in January. About 207,000 boys are now employed, as against 189,155 a year ago. The increase, however, is slight and unimportant, as it consists of green hands, quite inefficient as weapons of industry. The improvement is exaggerated for market purposes. For instance, a telegram from the *African World* reproduced in the financial Press of London, says that "the raw labour recruited during the week is becoming generally efficient." As if Kaffirs could be made efficient in a week. Then follows the oracular statement that "the effect on the output of the principal producing mines is expected to be a prominent feature in the early future." This is merely an example of platitudinous ineptitude.

We note that Mr. A. M. Robeson, consulting engineer to Eckstein & Co., has expressed himself in favour of eliminating the Kaffir by substitution, as far as possible, of the white workman. Mr. Robeson, who is an engineer of the first rank, is proud of the fact that at the City Deep no Kaffir is employed on the surface, and he expresses the hope that the next step may be the elimination of native labour underground also. This expression of views by one so well qualified to speak thoughtfully and intelligently is significant. We share the aspiration, having a strong belief in the superior economic value of high-priced labour, as against a migratory mob of cheap and inefficient workers.

The report that the East Rand Extension and New Boksburg mines were to cease work did not depress the market, as they had not been prominent. On the contrary, it is good news when unprofitable mines are shut-down on the Rand, for this releases workmen for other mines where they can be put to productive employment. The shutting down of the Western Rand Estates proved more depressing, especially as it was made known at about the same time as the arrangement whereby Wernher, Beit & Co. are to transfer sundry holdings in the Transvaal to Rand Mines, Ltd., that company being compelled thereby to create new shares for the purpose of this exchange. This news was badly received as it was taken to indicate the retirement of personalities second to none in useful influence. While such anticipations have been contradicted, we believe that they will prove measurably true. The organization of Wernher, Beit & Co. will, of course, be perpetuated by Mr. Louis Reyersbach and his able coadjutors, but Sir Julius Wernher and Mr. Friedrich Eckstein have no sons willing to follow in the business and it is understood in well-informed circles that they are taking measures to withdraw from the active work of an exacting business. The Rand Mines deal is only the sequel to the recent re-organization of the Central Mining & Investment Corporation.

It is reported that the Eagle stope-drill has given good results in the Village Deep and the South Randfontein mines. This is important, if true. A cheap and efficient drill would do much to correct the scarcity of skilful labour underground.

Some nervousness has recently been caused by the cabled reports of the debate in the Union House of Assembly on the Mine Regulations Bill, due to a fear lest the proposed limitation of the hours of labour should hurt the mining industry. It is believed, however, that the Bill under discussion will not seriously modify the laws now in force in the

Transvaal, although it will change those operating in other provinces of the Union. Prudential reasons would prevent the Government from passing legislation likely to hamper an industry from which it derives so much revenue, and in which, by its ownership of mining areas, it may expect further to profit.

RHODESIA.—The gold output for January is £8403 or 1995 ounces better than the preceding month, but this cannot be considered good, as December dropped £41,073 below November. As compared to January 1910 the decrease is £19,608, due to the cessation of production pending development at many of the larger mines. The Globe & Phoenix shows a gain of £11,616 as compared to December and a decline of £31,274 as against November. In fact, the changes in the total Rhodesian output are mainly due to the fluctuating production of the Globe & Phoenix.

Production of copper by the Tanganyika Concessions has again been postponed, the equipment of the blast-furnace having been stranded at Beira owing to wash-outs on the railway. Smelting at the Star of the Congo mine was announced to begin in April. A start is not likely until October. The blast-furnace is 48 by 192 inches at the tuyeres and has a capacity of 300 tons per day. Meanwhile no mention is made of the 'reduction' plant, involving the new process for treating silicious and oxidized copper ore, but we understand that the scheme has been shelved and that an effort is to be made to produce copper by smelting selected ore in the blast-furnace. Mr. Robert Williams leaves shortly for Katanga and it is probable that his visit to the property will be followed by fresh proposals for expansion. The Tanganyika enterprise is one that grows but does not fructify. Like some apple trees it appears better adapted to yield wood than fruit.

Shares in Giant Mines were introduced to the Bourse at Paris on February 16. French holdings are now large in several important

mines, such as the Mexico, Camp Bird, Shamva, Rhodesian Exploration, and Golden Horse-Shoe. Our friends across the Channel usually postpone participation to a late moment. But we like their invincible optimism.

The Gaika mill started crushing on February 25, and the Rose of Sharon is to start milling in May. The Belingwe announces an encouraging find on the surface.

The report by Mr. Gerald M. Browne, on the Cam & Motor mine indicates the approaching advent of another large producer. With comparatively little development 370,000 tons of $10\frac{1}{2}$ dwt. ore has been proved, and a plant to treat 10,000 tons per month is recommended. The ore is refractory, and it is to be roasted and all-slimes.

WEST AFRICA. — The monthly statistics are without special feature; the January output of 15,903 oz. compares favourably with the last six months, but is poor as against 17,357 oz. in January 1910 and 22,817 oz. in January 1909.

The finding of rich ore by a prospecting shaft on the Taquah Mining & Exploration Co.'s ground deserves notice. This prospect is 2100 ft. from the main shaft. A layer of banket assaying 36 dwt. over a width of 4 ft. was cut at a depth of 38 ft. From the Wassau also comes good news: the lode having been found on the 13th level beyond the fault. For a width of 4 ft. the ore averages $2\frac{1}{2}$ oz. per ton. This is far above the average of the mine, namely, 8'39 dwt. per ton. The Prestea mill is not likely to start until April, as the electric power will not be available until then; but once it does begin the results ought to cheer the entire Jungle market. At first the capacity of the mill is to be 12,000 to 15,000 tons monthly, increasing later to 25,000 or even 30,000 tons. The extraction is expected to average 40 shillings per ton and the total cost, after three or four months preliminary crushings, is estimated at 20 shillings. Thus a handsome profit should be earned, but we

doubt whether it will be as much as is forecasted. The total cost incurred, inclusive of all expenses, is likely to be more than 20 shillings, and when the maximum output is reached the average yield is likely to fall below that estimated; but a handsome output is assured in any event.

Much activity is reported in the Bauchi district. The wet season begins in May and by that time it is expected that enough machinery will be delivered to permit of active production. In the meanwhile some tin is being extracted by hand-labour and rudimentary sluicing. It is reported that the cost of shipping tin to England from these Nigerian mines will be £20. 10s. per ton. Statements concerning shipments are made in terms of "tons of tin," but in most cases the product is a concentrate of varying contents. We fear that shareholders do not understand this. The character of the output and the composition of it, in case it be a concentrate, should be clearly stated.

AUSTRALASIA.—The depressing effects of successive bad news from the big mines at Kalgoorlie was checked on February 17 by the announcement of promising drilling results at the Great Boulder Proprietary. Two diamond-drill holes made horizontally at the 2800 ft. level cut into ore of good grade at about 200 ft. Obviously this promising evidence can readily be confirmed by cross-cuts. It is likely to prove the continuation of veins already intersected on the 2500 ft. level. In any event it is highly encouraging—to the Golden Horse-Shoe, for example. A touch of humour is given to a position sadly in need of something pleasant by the cablegram from Mr. Sutherland claiming that one of the Great Boulder drill-holes had proved a lode 6 ft. wide assaying 22 dwt. per ton in the adjoining Golden Horse-Shoe ground. Similarly the drilling from the Great Boulder ground has given encouraging information to the Ivanhoe, in whose territory a vein 3 feet wide and

assaying 2 ounces per ton has been cut. We like to see good neighbours. The Great Boulder management deserves cordial thanks, at least. The latest estimate of the ore held in reserve in that mine shows an increase of 9000 tons and a decrease of 32,000 ounces of gold, as compared to the figures issued a year ago. The average content is one pennyweight less. The slump in Bullfinch Proprietary has demoralized the various 'pups' floated on the strength of the first important discovery. Recent telegrams indicate that the lode is not maintaining its richness and that unfavourable conditions are appearing at the water-level. Evidently a crisis in the history of this prospect is at hand. A collapse would be most unfortunate, not only for the shareholders, but for the renewed interest recently taken in West Australian exploration.

The branch railway to the Yilgarn district was opened for traffic on March 9 and the Bullfinch management has now no excuse for not pushing exploratory work. The rich discovery was made nearly a year ago and there has been time enough to have sunk the shaft several hundred feet, and to have proved the persistence or otherwise of the ore.

The Great Fitzroy is in bad luck. After making a new and promising start, the smelting was stopped for want of limestone, the shortness of supply being due to a flooded railway. The first telegrams indicated that the concentration of the gold-bearing copper ore was highly efficient, but the figures of extraction were so high as to arouse doubt as to their accuracy. A telegram received on February 28 gives 62 and 49% extraction for the copper and gold, as against the 90 and 93% stated in the first telegram.

Later still the flotation plant is stated to have given an extraction of 70% copper and 46% gold. The lack of uniformity in results illustrates the uncertain operation of flotation processes, which are dependent upon micro-physical conditions of a character as yet im-

perfectly understood even by scientists.

Some surprise has been caused by the policy recently adopted by the Zinc Corporation, whereby the Elmore flotation plant is gradually to be replaced by that of the Minerals Separation company. The reason for this move lies below the surface. The new plant has not been adopted because of its superior technical results or in order to avoid patent litigation, though the ostensible reason, which may or may not be incidentally a sufficiently good one, is that the remaining dump material is more amenable to the action of the new plant. The real cause is to be sought further afield. When the Zinc Corporation adopted the Minerals Separation process four or five years ago, a clause in the agreement provided that no other similar process should ever be used. The directors of the Zinc Corporation threw the process out in a few weeks and adopted the Elmore instead. The presence of this unfortunate clause was repeatedly pointed out to them, and now that the Minerals Separation process has been improved and has done good work at the Sulphide Corporation, the Minerals Separation people have been able to press the matter home. Since part of the plant has been altered the monthly reports show a decrease in the profit, and another unfortunate circumstance is that the Elmore companies have commenced a suit in Australia demanding a continuance of the payment of royalties, contending that they hold the master patents in Australia. It will be remembered that this claim was not upheld in the English courts, but as the lawsuit in Australia on the subject has not yet commenced the matter is still an open question at Broken Hill. We are informed that this law-suit is to be commenced in Sydney on May 22.

UNITED STATES.—Wall Street has been agitated by the decision of the Inter-State Commerce Commission on the subject of railway rates, and this has upset the equanimity of entrenched capital in America. Moreover,

the question of reciprocity with Canada has perturbed the upholders of a tariff that is the mother of monopoly. Hence the American share market has verged on a condition of panic, which, of course, has hurt mining, as well as other speculative forms of enterprise. But we do not expect to see any long period of depression. The general industrial position is sound and the resources of the country are not in Wall Street. For instance, Leadville, celebrated first for its gold placers, then for its silver and lead ores, has been revitalized recently by the development of a successful zinc industry. Both the carbonate and the silicate of zinc exists in large orebodies that are now being mined for shipment to the smelters in the valley. At Cripple Creek the self-reliance and energy of the community has been proved by the completion of a comprehensive drainage system through the Roosevelt adit. Now another adit, 500 feet deeper, is to be started, with State aid. It is reported that the Golden Cycle mine, at Cripple Creek, and the mill, at Colorado City, have been sold to the Consolidated Gold Fields of South Africa.

CANADA.—On February 14 the Consolidated Gold Fields paid the second instalment due upon its option upon the Rea claims at Porcupine. Prospecting with a diamond-drill is said to have yielded encouraging results. As is usual in snowshoe stampedes, most of the claims located at Porcupine were pegged without finding mineral in place, so that rights were obtained on false affidavits. Purchasers should be careful to assure themselves that the mining regulations have been observed, otherwise complications of title may ensue when the mine becomes valuable.

SPAIN.—A lengthy law-suit has just been concluded in London between the Rio Tinto Company and the Peña Copper Mines, the action being based on the allegation of the former that the latter was underselling and so committing a breach of agreement. After a

hearing extending over many days, a judgment was given in favour of the defendants. The case was exceedingly complicated; in fact, the report of it would make a valuable monograph on the methods of marketing copper and sulphur ore. Briefly the facts were these: In 1898 the defendant company's predecessors in ownership agreed that if the Rio Tinto company would build a branch railway to handle the Peña output, they would not undersell the Rio Tinto. During the last year or two, however, the average sulphur content at Peña has decreased and barite has become an undesirable constituent. Consequently difficulties have arisen in disposing of the output, and there was no option but to accept lower prices if the mine was to be kept going. The judge held that this cut in prices was not in contravention to the 1898 agreement, seeing that the agreement referred explicitly to the cutting of prices of similar grades.

MEXICO.—At the time of going to press the movement of American troops has excited anticipations of trouble. These are not likely to be fulfilled, for we regard American action as a preventive, not a provocation. Undoubtedly the Munroe doctrine carries with it the duty of policing the unstable republics south of the United States and it may be that the Government at Washington desires to prevent the necessity for European interference, such as might be required by eminent danger to English, French, or German life and property in Mexico.

The fire in the San Patricio shaft of the El Oro mine involved about 400 ft. of timbering. Repairs are under way and will not affect the output, which will be drawn from other portions of the mine. The estimate of the ore reserve in the Esperanza caused some disappointment, for it accentuates tonnage at the expense of yield. It may be pointed out that the profit of £412,393 does not include the revenue to be obtained from low-grade ore remaining in the part of the mine that was

worked by the previous owners, namely, the Mexican syndicate headed by August Sahlberg. This reserve cannot be computed with any accuracy, but it is bound to be considerable, having regard to the lowering of cost. The mill is treating from 600 to 700 tons per day and it has a capacity of 1000 tons. On that basis the working cost should be further decreased. Developments in the Santa Gertrudis, of the Camp Bird company, continue satisfactory. At the 18th level the main drift

that the mine will yet recover its old position. The dividend for 1910 paid by the Mysore was 115% on the nominal capital, the same figure as during the two preceding years. The progress reports are encouraging. In the bottom level in the Ribblesdale workings, the vein is 6 ft. wide and assays 3 oz., and in the lowest level in Tennant's the vein has the same width and assays over 2 oz. During the last month or so the quotation of the shares has been adversely affected by vague and indefinite ru-



MEXICO.

is being extended and the cross-cuts to the lode indicate a full maintenance of the lode's richness. The mill is to start in May, although increased returns must not be expected until June.

INDIA.—Recent developments at Champion Reef afford encouraging reading. At one point a vein is 21 inches wide and averages over 2 oz. gold per ton; at another the vein is 4½ ft. wide and assays 2½ oz.; and at a third the vein is 2½ ft. wide and assays 26 dwt. The shareholders are therefore inclined to be hopeful

that the mine will yet recover its old position. This famous producer has not had a set-back since 1893-4, and experienced people are justified in considering that £5. 10s. is too high a price for a 10s. share in so old a mine, though it is now paying 115% on the par value or 10% on the current quotation, and continuing to develop satisfactorily at the deepest levels.

The first of the yearly reports issued by the Kolar group is that of the Nundydroog. The outlook at this mine is considered to be highly satisfactory. The ore reserve has been in-

reached during the year and the developments continue to be promising. The Jibutil property at Anantapur recently tested on option by the Nundydroog Company has given sufficiently good results to warrant its purchase, and a subsidiary company is to be formed to acquire and work it.

SIBERIA.—Excellent progress is being made at Kyshtim. The smelter is running at normal capacity, namely, 500 tons per day, with continuous improvement in the technical results. Only $1\frac{1}{2}\%$ coke on the ore is being consumed; with a blast-pressure of 38 oz. a matte containing 22% copper is being produced. This matte is converted and electrolysed on the spot. In February the ore averaged 3.65% copper, which is above the estimate. At the mines, developments are satisfactory, especially at the south end, where the Karpinsky prospect is rapidly becoming an asset.

Atbasar gives equal satisfaction. More progress is being made than during any previous winter season. The ore-bearing areas already known are being enlarged by diamond-drilling and mining exploration. In summer new work of this kind will be started and for this purpose five additional drills have been ordered. The coal mines, which furnish the key to the situation, are proving fully as good as was expected; and for this department a Welsh superintendent has been engaged. Plant sufficient to operate this coal mine for three years is on the way. It will be remembered that the ore developed is oxidized ore averaging 14 to 17%, and bornite ore averaging 12 to 14% copper.

Lena shares have been rising on the approach of the productive season and the rumour, at St. Petersburg, that the grade of the output is to be fully up to the average, if not better. Washing of the gravel extracted during the winter is expected to begin in May. At the Orsk Goldfields a change of management has followed the resignation of Mr. C. W. Purington, who is succeeded by Mr. C. H. Munro, formerly at Nome, Alaska, and a specialist

in alluvial mining. Mr. Munro starts for Nikolaievsk in a few days, and in the meantime Mr. D'Arcy Weatherbe, who resigns in June, is in charge of operations.

VARIOUS.—Weir's shaft of the Copiapo mine is on fire, according to a cable received on January 30, and it has been sealed with a view to minimizing the damage. An attempt to open the mine will be made shortly. This is an old mine, first worked in 1836, and is situated in Atacama, Chile. The deepest workings are 2700 ft., and the ore produced averages 7% copper. Like other copper mines in Chile, the Copiapo has suffered on account of the low price of the metal.

The Butters Salvador discovery has been confirmed by mail. At the 700-ft. level a vein 5 ft. wide has been cut, the rich ore consisting of a streak 4 inches wide of stuff that assays 65 oz. gold per ton. The remainder of the vein contains only 6 to 7 dwt. per ton, and the whole width of 5 ft. assays 6 oz. per ton. More work is needed to ascertain what is the real nature of this occurrence.

Among the flutters of the month may be mentioned a rush to British Guiana, on the discovery of gold placers in the district of Menamu, on the Venezuelan border. Lawlessness and disorder have prevailed, and reliable news is not obtainable. Another item relates to Egypt. The daily Press has contained a paragraph, cabled from Washington, stating that a consular report "gives prominence to the possibilities of gold mining in Egypt," especially near Assouan. As regards this subject, plenty of information is available in London, but it would not be stimulating either to investment or speculation in gold mines situated in the land of the Pharaohs.

Thanks to getting £20 more per ton for the tin produced, the Dolcoath mine has been able to pay an additional dividend and to give a cheerful annual report. The new Williams shafts has been sunk to 3000 feet and is being equipped for use.

STATISTICS

STOCKS OF COPPER IN ENGLAND AND THE CONTINENT

	Dec. 31 Tons	Jan. 31 Tons	Feb. 28 Tons
In England	66,917	65,872	66,239
In France	6,080	6,896	6,648
Afloat from Chile	3,600	3,100	3,000
Afloat from Australia	7,200	7,325	6,500
Total	83,797	83,193	82,387
In Rotterdam	6,800	7,600	7,600
In Hamburg (estimated)...	15,000	15,000	11,000

AMERICAN COPPER PRODUCERS' ASSOCIATION.
In Tons of 2,240 lb.

	Produc- tion.	Domes- tic	Foreign	Total	Stocks at end of month
November 1910.....	53,282	27,143	30,100	57,243	58,209
December 1910.....	55,062	19,460	39,332	58,792	54,479
Year 1910.....	648,268	334,563	322,514	657,077	
January 1911.....	51,650	18,785	23,753	42,538	63,591
February	49,000	22,553	20,139	42,692	69,929

PRODUCTION OF GOLD IN THE TRANSVAAL.

	Rand	Else- where	Total	Value
	Oz.	Oz.	Oz.	£
July, 1910	610,664	28,050	638,714	2,713,083
August	623,129	26,140	649,269	2,757,919
September	624,311	25,588	649,899	2,747,853
October.....	627,445	25,702	653,147	2,774,390
November	617,905	24,686	642,591	2,774,390
December.....	616,668	24,117	640,995	2,722,775
TOTALS 1910	7,228,588	305,532	7,534,120	32,002,912
January 1911	625,862	25,201	651,027	2,765,386
February	585,683	24,965	610,828	2,594,634

COST AND PROFIT ON ALL RANDE

MONTH.	Tons	Yield per ton	Costs per ton	Profit per ton	Total profit
		s. d.	s. d.	s. d.	£
January 1910....	1,754,140	27 7	17 0	10 -	924,275
February	1,614,730	28 5	17 6	10 10	874,746
March	1,767,059	27 6	17 1	10 4	913,759
April	1,763,104	28 1	17 6	10 7	927,244
May	1,785,821	28 3	17 6	10 9	958,347
June	1,766,737	28 1	17 9	10 5	921,136
July	1,814,686	28 1	17 8	10 4	937,456
August	1,834,105	28 1	17 8	10 6	961,304
September	1,835,647	28 1	17 11	10 4	942,330
October	1,868,718	28 0	17 9	10 3	952,161
November	1,800,371	28 6	18 0	10 10	951,773
December	1,827,423	28 1	17 9	10 5	952,574
January 1911....	1,865,232	28 0	17 11	10 1	930,059
Totals and aver- ages for 1909..	20,543,750	28 11	17 1	10 6	11,794,376
Do to 1910.....	21,432,541	28 6	17 7	10 6	11,216,105

NATIVE PRODUCTION OF TRANSVAAL MINES

	Gold mines	Coal mines	Diamond mines	Total
October 31	180,000	8,528	8,068	196,699
November 30	178,027	8,367	8,362	194,756
December 31	178,602	8,354	9,939	196,895
January 1	183,268	8,357	9,991	201,616
February 28.....	180,000	8,513	9,814	207,761

GOLD OUTPUT OF INDIA

Year 1909	Year 1910	February 1911	1911 to date
£2,083,901	£2,104,858	£166,106	£343,814

PRODUCTION OF GOLD IN RHODESIA.

MONTH.	1908	1909	1910	1911
	£	£	£	£
January....	199,388	204,666	227,511	207,903
February ..	191,635	192,497	203,888	-
March ..	200,615	202,157	228,385	-
April ..	212,935	222,700	228,213	-
May ..	223,867	225,032	224,888	-
June ..	224,920	217,600	214,709	-
July ..	228,151	225,234	195,233	-
August ...	230,792	228,296	191,423	-
September ...	204,262	213,249	178,950	-
October	205,466	222,653	234,928	-
November.....	196,668	236,307	240,573	-
December..	217,316	233,397	199,500	-
Totals ...	2,526,007	2,623,788	2,568,201	-

PRODUCTION OF GOLD IN WEST AFRICA.

	1909		1910		1911	
MONTH.	Oz.	Value	Oz.	Value	Oz.	Value
		£		£		£
January	22,817	91,112	17,357	70,699	15,903	66,107
February	21,403	86,210	16,976	68,469	-	-
March	23,186	93,556	17,627	71,954	-	-
April	21,491	88,071	16,363	67,069	-	-
May	25,104	100,056	16,590	68,355	-	-
June	17,340	70,561	17,194	70,988	-	-
July	17,331	70,523	15,564	58,551	-	-
August	17,766	71,614	13,921	57,713	-	-
September...	18,125	72,963	11,497	47,746	-	-
October	15,957	65,813	13,341	55,046	-	-
November ..	17,882	73,824	14,021	57,658	-	-
December ...	17,570	71,332	15,042	61,737	-	-
TOTALS	235,972	955,635	185,493	755,985	-	-

PRODUCTION OF GOLD IN WESTERN AUSTRALIA.

MONTH.	Export oz.	Mint oz.	Total oz.	Total value
				£
Total, 1910	363,496	1,209,856	1,573,352	6,682,042
January 1911	17,463	102,035	119,498	507,590

OTHER AUSTRALIAN GOLD PRODUCTION

	1909	1910	February 1911	1911 to date
	£	£		
Queensland	1,916,468	1,840,337	115,100	217,910
New South Wales	869,546	803,727	76,198	133,104
New Zealand.....	2,006,910	1,896,322	106,366	302,149
Victoria	2,897,340	2,422,700	305,300	439,300

SALE OF TIN CONCENTRATE AT REDELFIELD

	Tons	Value	Average
Year 1910.....	6,102 3/4	£619,000	£101 19 0
January 9, 1911	215 1/2	£23,778	£110 19 0
" 23, "	200 1/2	£23,121	£115 4 3
February 6, "	17 1/2	£22,409	£115 4 4
" 19, "	14 1/2	£24,721	£168 11 8
March 6, "	14 1/2		

EDITORIAL

MATTERS in connection with the Mining and Metallurgical Club are progressing most satisfactorily. Evidently the proposed move to new quarters in the City has met with enthusiastic support. It remains for the members to subscribe cheerfully to the furnishing fund.

OLD STUDENTS of the Royal Mines will be glad to know that the annual dinner takes place on May 4 at the Café Monico. Sir Thomas Holland, lately director of the Geological Survey of India, will preside. Other distinguished men will be present as guests and interesting speeches are assured. It is hoped that the attendance of graduates of the School will be large and representative. Those desiring tickets should address the honorary secretary, Mr. Arthur C. Claudet, at 6 Coleman Street, E.C. Promptitude is essential.

AMONG the standard-bearers of the profession for the current year are Mr. Charles Kirchhoff, who has been elected president of the American Institute of Mining Engineers, and Mr. J. Parke Channing, who has been chosen for similar honour by the Mining and Metallurgical Society of America. Messrs. F. W. Bradley and C. W. Goodale are vice-presidents of the latter society, and Mr. W. R. Ingalls is now secretary. In all these cases the selections are most fortunate and represent the best type of American engineers. Both societies are doing good work in diverse ways, and we trust that they may continue as prosperous as they are useful.

ON another page we give a summary of a most suggestive and scholarly paper by Mr. C. Baring Horwood on the occurrence

and origin of the carbon found in the Witwatersrand conglomerate. This paper was read recently before the Geological Society of South Africa, and affords an excellent example of the scientific investigations made by mining engineers on the Rand. Mr. Horwood traces the carbon to neighbouring dikes and imputes the origin of both the gold and its associated carbon, especially in the Rietfontein and Randfontein mines, to magmatic exhalations. We commend the paper to mining geologists.

MINING as a profession has lost one of its most honourable exponents by the death of John C. F. Randolph. He was one of the first graduates from the Columbia School of Mines, and was a leading practitioner twenty-five years ago, especially in Mexico, Colorado, and the West generally. Owing to his keen sense of propriety and professional integrity he withdrew from active work at a time when the business of mining was most active, finding it impossible to reconcile his own severe standard with the commercial code of the day. John Randolph was an engineer who never received a contingent fee and kept his hands entirely out of promotion. He was a man of unswerving opinions concerning what an engineer might do and what he should not do, and therefore he was deemed an extremist by the more adaptable of his contemporaries. We regret so few are like him and we honour his memory as that of one who set an example difficult to follow, worthy to be imitated.

During the past month two other members of the profession have crossed the range from which no prospector returns: Rupert C. Alabaster and Frank C. Knight. The former was a graduate from the Royal School of Mines

who served in the Royal Artillery during the Boer war and afterward resumed his career as a mining engineer, working in America and other countries before he became manager for the Oonah mining company in Tasmania, where he died. Rupert Alabaster was a clean-cut, manly, and intelligent Englishman, of whom much good work was to be expected. The untimely ending of his promising career will be sad news to all that knew him. Frank C. Knight also was an Englishman, although his technical experience was largely gained in America. Leaving the St. Helens smelter he went to Colorado, where he became chemist and then superintendent of the Boston & Colorado company's smelter at Argo, near Denver, under the direction of Mr. Richard Pearce. Subsequently he was at the Garfield smelter in Utah. For the last three years he superintended smelting operations at the Spassky mine, in Siberia. He died in Russia when about to return to England on account of ill health. He was one of the unobtrusive hard-working type and performed his duties with constant devotion. His name had just been proposed for membership in the Institution, and the application had been fully endorsed.

WE NOTE with regret that the Western Association of Technical Chemists and Metallurgists is to be disbanded. This organization was formed at Denver six years ago and it rapidly won recognition as a society of high professional standing. Its monthly organ, *The Western Chemist and Metallurgist*, though consisting of only a few pages, was carefully read by metallurgists and chemists in all parts of the world, for it always contained some information of value. It is not easy at any time and under any circumstances to maintain a high standard of excellence in the papers presented by a society or by a periodical. In the case of the Denver society, the difficulties were increased by the absence of funds wherewith adequately to recompense

a professional man in exchange for his services as editor or secretary. Moreover, the members did not come forward readily with papers, and the responsibility eventually falling on the shoulders of the faithful few became too great to bear. The cost of the monthly journal also caused anxiety, for, the scope of the society being restricted, the membership and the revenue were small. Speaking for ourselves, we express regret at the discontinuance of a journal that we have always welcomed as a helpful and illuminating publication.

THE REPORT of Mr. R. E. Williams on the Waihi mine was followed immediately by the announcement that Mr. G. A. Richard had been commissioned to make a special examination, and an abstract of Mr. Richard's report was transmitted by cable within a week. Events followed each other so fast as to excite surprise. How could Mr. Richard, who is manager of the Mount Morgan mine, in Queensland, go to New Zealand and examine so big a mine as the Waihi all in one week? The explanation is found in the fact that the Australasian Institute of Mining Engineers was in session at Thames, on the Hauraki goldfield, that is, in the vicinity of the Waihi mine, at the beginning of February. Mr. Richard happens to be the President of the Institute and was there. He had probably visited the mine on former occasions and already possessed the confidence of the management, which, with his wide and honourable reputation, rendered it expedient to engage his services at this critical juncture. Thus he was able to make a report promptly. It is a clear pronouncement of opinion and is what we would expect from a man of his high character, but it is not the opinion most needed at the present time. As we have said before, the crisis in the Waihi's life calls for the diagnosis of a skilful geologist of wide experience and highly scientific

training. Mr. Richard's report is useful but not satisfactory.

SINCE the publication of our criticisms on the manner in which the directors of the Golden Horse-Shoe Estates treated Mr. Henri Kuss, our attention has been drawn to the controversy between the same board and Bewick, Moreing & Co. in 1905. We have read the speech made on April 27, 1905, by the Chairman, Sir John Purcell, and the letter in reply, written by Mr. H. C. Hoover and appearing in the *Mining World* of April 29. It is easy to write last year's almanac, but it is also profitable occasionally to look backward for the causes that may have produced recent events. At that time the Chairman undertook to castigate a firm of mining engineers that has led the way in the efficient management of mines in Western Australia, and he undertook to place a stigma on Messrs. Moreing, Hoover, Loring, and Wellsted. Fortunately for them the records of the Ivanhoe, Great Fingall, Sons of Gwalia, and other big mines in the same region have proved their ability as managers and they have outlived the attack then made; on the other hand the blunders alleged by Bewick, Moreing & Co. to have been perpetrated by the Golden Horse-Shoe directors have been duplicated since then. Mr. Kussin 1911 was treated like Mr. Hoover in 1905. History repeats itself.

THOSE engaged in mining will feel a kindly interest in the appointment of Mr. John Hays Hammond to represent the President of the United States at the forthcoming coronation of King George V. Although Mr. Hammond is now a financier and promoter of international reputation, he began his picturesque career as a mining engineer, and we look at the latest honour conferred upon him as testifying to the high social status enjoyed by successful professional men in America. In Europe a mining engineer or a professional

promoter would be extremely unlikely to be chosen as the diplomatic representative of his country at a State ceremonial, and we regard the unconventional appointment made by Mr. Taft as testifying emphatically to the *carrière ouverte aux talents* and the equality of opportunity freely accorded in the great Republic across the sea. We have expressed disagreement with some of the views on mining affairs advocated by Mr. Hammond, and we dislike his notion of the functions of a consulting engineer, but at this time we take pleasure in congratulating him on the great honour conferred upon him by the President.

IN *The Times* of February 13, Mr. Gerard W. Williams gave an interesting description of the Bullfinch discoveries. Like all unprejudiced accounts this emphasizes the fact that the recent boom was wholly based on "a prospect, proved to shallow depth, and for but little linear extent." He deprecates the injudicious enthusiasm of the Premier and the haste of the Government in building the branch railway. As to the latter, we can appreciate that a paternal Government builds railways not only to gain revenue, but to promote industry, especially an industry so vital to the development of the State's natural resources. We hope Bullfinch will fully justify the Government's enterprise. Much will depend on exploration in depth, to ascertain whether the Bullfinch discovery is a big pocket, like others that made Western Australia unpleasantly famous, or a persistent ore-shoot, large enough to become the basis for many years of successful operation on a large scale. In other words, does the rich ore cease with the jasperoid ironstone at water-level, as it did on the Butterfly leases on Lake Lefroy, at Widgiemooltha, at Mt. Morgans, at Golconda, at Lake Austin, and at several mines in the Southern Cross district near-by? Whether the ore persists or whether it peters out, nothing will ever justify the booming of the share-value of the Bull.

finch Proprietary to £1,500,000, on the showing made by the shallow shafts and short drifts constituting the total development at the time of flotation. Mr. Williams says that the ore available, or probably available, "cannot by any stretch of the imagination be appraised at £500,000. Half that figure would be a fair estimate." This is gross value; the profit would be about one-half. Thus the work done since December has not changed the position. We then assumed an assured profit of £250,000. The mine is still being valued at nearly a million pounds sterling. The profit assured is just enough to pay one year's dividend at 25%, which is not too much for so speculative a venture.

THE DECISION of the Consolidated Gold Fields to increase the capital by the issue of preference shares for £1,250,000 was formally endorsed at a general meeting on February 21, one half of the amount required having been previously underwritten. The speech made by Lord Harris was businesslike and to the point, emphasizing the fact that the wasting assets in the Transvaal must be replaced by new sources of income if the company is to retain healthy vigour. The necessity for such a policy was made evident at the annual meeting. It is logical. The company has an organization that should be profitably perpetuated by a policy of reasonable expansion, as in America and Rhodesia. The staff of engineers especially is one that should inspire confidence. Mr. Harry H. Webb won his spurs long ago and has kept them untarnished. Baron Von der Ropp, who combines the charm of European antecedents with the shrewdness gained from a wide American experience, is a metallurgist of note and a skilful negotiator; in the Transvaal, Mr. C. D. Leslie is a superintending engineer whose capacity for important work has been increased by his early experience as a contractor and later as mine mana-

ger: in Rhodesia, Mr. H. A. Piper is a man of exceptionally wide experience in that part of Africa, where also he enjoys a high reputation; in West Africa, Mr. Henry Hay, formerly conspicuous for good work on the Rand, is engaged in the difficult task of reorganizing the operations of several companies; on the mechanical side, Mr. Hans C. Behr, at Johannesburg, is recognized as an able designer and responsible for many improvements in connection with deep-level mining; as a metallurgical specialist, the Gold Fields company is fortunate in retaining the services of Mr. W. A. Caldecott, recognized as a leader in the progressive advance of cyanidation as applied to banket ores. Thus it is evident that this company is strong in professional men of high character and it gives us pleasure to anticipate a wider field for their useful energies.

FROM TORONTO we publish the current gossip concerning Porcupine, from which it will be seen that great things are expected from Mr. C. Algernon Moreing's visit to this goldfield. We understand that he has taken options on a number of claims adjoining the most promising mines, and that a systematic scheme of exploration will be adopted. We can well imagine that the local Canadian papers will use Mr. Moreing's interest in Porcupine as a fine argument for booming this part of Northern Ontario, and we expect that the distinguished senior member of the firm of Bewick, Moreing & Co. will be accorded all sorts of brevet rank in the profession of engineers and the trade of promoters. Indeed, if any of our friends care to feel that they have touched the pinnacle of fame, let them visit a mining camp when glorified by a boom. As we write we have before us a flamboyant article that appeared recently in the *New York Sun*, a paper as remarkable for its ability as for its irresponsibility. We are there informed that Mr. William Frecheville, "an

associate of the Royal Society of Mining, and probably the greatest authority on mining in the world," has given a favourable verdict on Porcupine. Also Mr. Harry H. Webb, "a man with a string of scientific titles a yard long," has committed himself unreservedly on the subject. Knowing the modesty of Messrs. J. S. MacArthur and Charles Butters we refrain from quoting the terms in which the New York scribe refers to them. Our readers will not be surprised that in the accompanying description of the mining district the colours are laid thickly. "Great true fissure veins," "greatest gold mine ever discovered," "spectacular showing of free gold," "a boom that will outdo everything of its kind in the last century"—these are some of the bright spots in a gaudy picture. But none of this drivel conveys any information. It is the burlesque of mining, and it is unfair to Porcupine, which really does possess three or four promising prospects, all of which are now being tested by shaft-sinking and diamond-drilling. Several London syndicates have sent representatives to the goldfield, and most of them have reported inability to do business because the prices asked were absurd and the evidence of value wanting in the case of the particular claims placed under offer.

SAN FRANCISCO has been chosen by the American Congress as the site of an international exposition in 1915 to celebrate the completion of the Panama canal. The funds available for the purpose include \$7,500,000 raised by private subscription, \$5,000,000 voted by the City, and \$5,000,000 provided by the State of California. In addition, the State has voted to issue bonds for \$10,000,000 to improve the San Francisco water-front and \$18,000,000 to build a system of public roads. The improvements last mentioned will contribute greatly to the setting given to the exposition itself. Since the earthquake-fire, no less than \$170,000,000 has been spent by

individuals and corporations in re-building San Francisco and a further sum of \$25,000,000 in public money has been expended in beautifying the City and its environments. Before 1915 as much more money is likely to be used for additional construction; so that, apart from the exposition, an exhibit will be made of a reconstructed City on lines unparalleled in human history. The spirit that conquered the calamity of 1906 is indeed capable of great things. These many millions are impressive, but to us a more significant item of news is a cablegram stating that Ruef, the instigator of the municipal corruption that disgraced San Francisco and the central figure in the judicial proceedings that scandalised California, has been finally committed to jail for 15 years by the Supreme Court of the State. Thus the heroic work of Mr. Francis J. Heney and his co-workers has brought forth fruit after almost interminable delay. We never doubted that San Francisco could build fine structures and spend money lavishly for enjoyment and advertisement, but we did doubt whether she could prove superior to a sordid materialism. To us it seemed ever a strange anomaly that a community possessing so great a spirit in one direction should fall so pitifully low in another, that energy should be divorced from character, and ability from rectitude. But even this blemish is to be removed. The forces of reform, beaten back repeatedly, have finally triumphed and throughout the State the tonic of a healthy public opinion is stimulating the civic spirit of a great people. This was indicated at the recent election when Mr. Hiram W. Johnson was elected Governor, thus breaking the maleficent control of the railway bureau and affording promise of political emancipation.

MANY PROSPECTUSES of oil companies are ready for issue, and some of them are now appearing. Whether the interest shown in oil ventures this time last

year is to be repeated, we do not know. We hope it may, for this branch of industry is capable of profitable development. In the meanwhile, we venture to urge speculators to insist upon ample and trustworthy information. As California and Mexico are likely to be the scene of some of this financial incubation we think it well to point out that the opinions of distinguished citizens, mining officials, and local professors are usually worthless as evidence regarding the dividend-earning capacity of a mining enterprise. The only testimony worth having is that of a reputable specialist not participating in the profits of promotion. For instance, a petroleum company issues a prospectus in which the reports concerning the value of the property consist mainly of quotations from the publications of the Mining Bureau of California. That Bureau has employed some capable men, but all its work is vitiated by the fact that its chief, the State Mineralogist, is practically the nominee of the Southern Pacific Railway as represented by a political bureau that has corrupted the State of California for years past. The present State Mineralogist has no standing as a mining engineer, geologist, or scientific man, and any reports issued by him are discounted to nothing by the further fact that the Southern Pacific Railway is itself indirectly but largely interested in the oil business of California. On the other hand, the publications of the United States Geological Survey are trustworthy and give much valuable information. But even in this case the general data concerning a district can well be twisted by the unscrupulous as an endorsement of a specific property and thus be used to mislead. Government reports are not made on individual properties but on large areas and on general conditions. English companies speculating in oil land anywhere should pay for the advice of independent specialists having the character and experience necessary

for such work. In California several men of this kind are available, as well as in London. There is no excuse for quoting the opinions that have cost nothing and are worth just what they cost.

Directors.

We are indebted to Mr. Thomas Skinner for two valuable publications, 'The Stock Exchange Year Book' and 'The Directory of Directors.' These publications serve to give data for measuring the growth of the business activities incidental to the industry of mining. All of them are not beneficent. Thus the responsibilities of a director are taken too lightly by many men who ought to know better. An addition of 2600 new directors to joint-stock finance in 1910 is attributable largely to the rubber boom. As usual a number of men are conspicuous for multiplicity of directorships, Mr. Edmund Davis being first with 33; Mr. C. F. Rowsell is second with 28, and Mr. C. Rube is third with 27. Seven others hold at least 20 directorates. We are glad to note that one or two gentlemen have decreased their responsibilities as directors, but too many are still scattering their services more than is good either for them or the companies on whose boards they sit. No less than 229 members of Parliament are directors of public companies. This is open to criticism. The whole system is not taken as seriously as it ought to be. No matter how capable and energetic a man may be it is extremely unlikely that he can serve faithfully as a trustee for the shareholders—and that is the function of a director—if he scatters himself on a dozen boards or more. Most directors assume nominal responsibilities and draw nominal fees. The real work of management is performed by one or two men, who are no better paid than those who make a hurried or perfunctory visit to the board-room and excuse themselves on the plea of pressing business elsewhere. Of the 22,000 directors named in

Mr. Skinner's manual it is probable that more than half serve a purely decorative purpose, and one quarter of them are merely incompetent poseurs designed to impress a public that thinks distinction or notoriety in one walk of life fits a man to serve on the administration of a corporate enterprise. We hope the day may come when the fact of a man holding 10 directorships will cease to be a recommendation for his election to an eleventh board and when a director of 20 companies will be recognized as performing nominal duties so numerous as to be incompatible with efficiency.

This Month's Correspondence.

We refer our readers to the extremely interesting comments of our Melbourne correspondent, who writes in a most informing style concerning the zinc industry of Australia, especially as regards the German participation. Such trade movements are of fundamental importance. It is regrettable to learn that a lack of initiative explains British loss of control over an important industry and that similar want of enterprise threatens the smelting business, so long a technical and commercial advantage to Great Britain. Undoubtedly ores from Australia, South America, and Europe that formerly went for treatment to England and Wales—especially the latter—are now diverted to Antwerp, Liège, and Hamburg.

Our San Francisco and New York representatives send letters that throw trustworthy light on current events in America. The proposed reciprocity between Canada and the United States has attracted keen interest, partly political. Our correspondent at New York gives some useful data on the arrangement as it affects the mining industry. He also refers to the development of Alaska, especially the Copper River region, which was the subject of so much exaggerated talk four years ago. From San Francisco we get news of remedial legislation affecting the oil industry and estimates of the copper production, besides sun-

dry timely notes on recent progress in cyanidation, particularly in Colorado.

Our Johannesburg correspondent, as usual, is much to the point and transmits his views on matters with which he is closely in touch. The Rand is a lively locality and always affords something interesting. This time he refers to the tin boom, the work of the Geological Society, the results from Crown Mines, and changes in the personnel of the big companies. From Toronto, Vancouver, and Mexico we publish the latest intelligence concerning current progress. Our correspondent at Lima, in Peru, sends a review of the mining industry in that country.

Mexican Unrest.

The cablegram from Mr. R. H. Jeffrey, manager of the Avino mines, in Durango, stating that a band of rebels had taken possession of the property, bringing operations to a standstill, affords unexpected testimony to the fact that the revolution in Mexico has not been suppressed. As usual, the authorities have ordered the representatives of Mexico to assert that no revolution existed and that all was well, while, on the other hand, the less responsible part of the American Press has freely exaggerated the situation with a view to creating further trouble. It may be taken that the truth lies between perfect peace and unlimited pandemonium; Mexico is still under the sway of Diazpotism and is not in a state of anarchy. Autocratic governors, greedy concessionaires, enterprising promoters, picturesque *rurales*, patient *peons*, rampageous Indians, and all the ingredients of a romantic burlesque of civilization are still in existence from the Rio Grande to Yucatan. But anyone desiring to comprehend the position must understand that the Americanization of the four northern states of Mexico has been proceeding quietly for the last twenty years, until so large an amount of American money and American sentiment has been imported into that portion of the country

as to prepare the way for annexation—preferably by peaceful means, in which dollars, not soldiers, will figure. Sonora, Chihuahua, Coahuila, and Sinaloa are, we fear, destined to be placed under the American flag. We “fear” it because the United States has as much territory as she can comfortably assimilate, and the addition of more is likely to check the real progress of a country to which we always look with friendly eyes. Baja California, or the peninsula of Southern California, is also likely to be absorbed by the United States. This tract of infertile land, rich in mineral deposits, accessible with difficulty from Mexico City, is wretchedly governed in consequence, and is so close to the American nerve centres, that its fate appears inevitable. And in the unrest leading to change it is not politics but business, not sentiment but exploitation, that is the determining factor. Nothing may be done while the aged President remains at the helm of the Mexican government, but whenever he resigns, to his vice-president or to a dictator more dreaded than himself, the facts we have submitted will be translated into action.

Fine Grinding.

On another page we publish a thoughtful article by Mr. H. S. Denny on an important phase of cyanidation. He is well equipped to discuss the subject usefully. Referring to the suggestion that amalgamation should be discarded, it is interesting to note that the Alaska Treadwell company is considering the rejection of amalgamation, although at the present time as much as 72% of the extraction is effected by the use of mercury. The apparatus used includes a series of amalgam plates for coarse pulp, another series for fine pulp, and two Pierce amalgamators. If this part of the treatment were omitted the plant undoubtedly could be simplified and cheapened. Apart from this feature the flow-sheet of the Treadwell indicates that it has been designed much on the

lines advocated by Mr. Denny for the treatment of a clean gold ore. Of course, if in a mill extracting 72% by amalgamation it is thought desirable to reject the old method, then the argument in favour of using cyanide without mercury becomes fortified as applied to cases in which amalgamation plays only a subordinate or a supplementary part. At the Treadwell the loss of quicksilver and amalgam is large and the extraction by cyanidation throughout is as good as it is by the combination of cyanidation and amalgamation. We feel sure that the able manager of the great mine in Alaska, Mr. Robert A. Kinzie, will read Mr. Denny's timely article with keen interest, and we hope that either he, or his metallurgical assistant, Mr. W. P. Lass, will contribute their views on the subject. The plant designed by them to avoid the transport and treatment of concentrate at the Tacoma smelter presents many interesting features, including the free use of air-lifts, the adoption of Callow tanks, Pachuca agitator-vats, Kelly filter-presses, and Merrill precipitation presses. In another part of the world, namely Colorado, similar problems are being attacked vigorously, as is shown by an interesting paragraph in our San Francisco letter. Several advances in established practice have emanated from Colorado, where the large output of low-grade ore from Cripple Creek has stimulated competition between the mills and the smelters. Just now the Clancy process, controlled by the Moore Filter Company, is the subject of controversy, after having been used successfully in the Portland mill. It involves the application of calcium cyanamide in place of the more expensive cyanides. Apparently the innovation has merit, for a dispute has arisen between Messrs. J. C. Clancy and D. Mosher as to the credit for originating this interesting departure. New processes seem fated to undergo the baptism of litigation, most of which is avoidable. In Nevada several excellent plants have been erected and we note a tendency to add tube-

mills, vacuum mills, and other re-grinding machines. An echo from Western Australia is suggested by the use of bromo-cyanide at Goldfield for the treatment of concentrate.

Gold in France.

The fact that France can boast two or three productive gold mines and one at least worthy to rank among the notable enterprises of the day is interesting alike to students and to economists. For France was once a country yielding much gold, although the time to which we refer is so long ago as to be veiled by distance. Augustus derived a large tribute in precious metals from the Gauls and it is related that in 15 B.C. the Roman procurator Licinus took the man who was president of the Republic and the adopted son of Julius Cæsar to a large room full of gold and silver that had been extorted from the natives for the support of the government on the Tiber. At the close of the civil wars that ended with the Roman conquest of Gaul the people of the country are said to have shown much energy in prospecting for the precious metals. In the ancient world the possession of mines was a great source of strength and it requires no vivid imagination to realize that throughout human history, ever since the precious metals were used to facilitate barter, the successful exploration for gold and silver has provided the sinews of war and the lubricant of commerce to the peoples of the earth.

In his timely and interesting article on the La Bellière mine, Mr. Thomas T. Read, who is now associate editor of the *Mining and Scientific Press*, expresses surprise that France should possess several productive gold mines. It is true, these mines are not of international importance, but they are well worthy of study, as was also shown in the article by Mr. James A. Rickard, appearing in our issue of December 1909. During 1910 the La Bellière produced 8500 tons of ore, yielding 38,783 ounces of gold and 5211 ounces of silver,

together with 274 tons of white arsenic. The total value of this output was £175,000. In addition to the La Bellière we may mention the mines of La Lucette, Chatelet, Salsigne, and Villanière. The mineral mispickel, or arsenical pyrite, is characteristic of the gold ore in most of these cases, although at La Lucette the presence of stibnite is a distinguishing feature. This is the reason probably why exploitation has been tardy, but it must be added that proof is not wanting that gold mining has persisted with varying energy in France from the dawn of history through the Middle Ages down to our own times. One mine, for example, at Bourg d'Oisans, in the Dauphiné, was worked successfully by the Greeks, the Romans, and the Saracens. This mine, called La Gardette, was operated by the Count of Provence in 1783 and by two Englishmen in 1862, but it is now idle, for the excellent reason that the vein is too poor to be profitably worked. In later times we find that Napoleon III. stimulated interest in the subject. This led to systematic efforts to exploit the quartz and mispickel veins so numerous in the Auvergne, La Vendée, Dauphiné, and Aquitaine. To this revival and the improvement in metallurgical methods are owing the better prospects of gold mining in France.

A Supposed Paradox.

In a recent issue *The Economist* expresses surprise that the fall in the price of tin has not caused a decline in the quotations for Nigerian tin-mining shares. The reason is fairly obvious. The price of tin can only affect the metal offered on the market; as the Nigerian companies are mainly engaged in prospecting, they are not affected by the price of a commodity that will have many chances to go up and to go down before the mines reach a productive stage. Moreover, the quotation for shares depends on many factors, of which the value of the metal produced is only one. We may go so far as to say that

the quotation depends on many things, even the condition of the mine. But it depends to a greater degree on one other factor, namely, the ratio of buyers to sellers. As a rule it is more useful to know who is buying or selling a particular stock than it is to have complete information concerning the mine itself. The information may be variously interpreted, it may be variously trustworthy; it may be timely or it may be belated. And whatever it may be, if influential people are buying, and are known to be buying, the shares will go up, while no cheerful cablegrams from the mine can long prevent the depression caused by free selling of shares by leading market operators. To those who buy to hold, the vagaries of the share market may not matter, as long as they possess information concerning the intrinsic value of the property, but to the speculator who buys for a quick turn the fundamental conditions are secondary to the immediate effect of market operations and share manipulation. A striking example has been afforded repeatedly by the Amalgamated Copper shares, which properly regarded are not shares in a consolidation of mines but counters for a lively gamble. At the average market quotation they yield 2% in a country where bank depositors can get $2\frac{1}{2}\%$. Of course, no one holds the shares for their income-bearing quality; they fluctuate from year to year between \$30 and \$135, and in the periodic see-saw the shrewd insiders clean up a fortune, most of which represents the losses of the small dabblers whose margins have been swept away. In a case like this the basic conditions of the copper industry are secondary to the financial activities of Standard Oil, of the Boston filibuster, or of other predatory combinations. When labour troubles have caused a cessation of production from the Butte mines it has often happened that the shares of the speculative Utah and Arizona mines have risen. One would have thought that the temporarily diminished output of Butte would

strengthen the copper market and the copper share market also. But here, as in the Nigerian case, the price of shares is dependent upon causes only remotely economic.

Expectations in Mining.

The reports of company meetings are often interesting, especially when they deal intelligently with the technical aspects of mining; therefore we are glad to see publicity given to them in our advertising pages. For instance, the proceedings at the Oroya Exploration meeting are well worth careful reading by reason of the explanation of mine valuation offered by Mr. H. C. Hoover. As chairman on that occasion he gave the shareholders a most illuminating exposition of the proper basis for appraising the prospects of a mining enterprise, and accompanied his explanation with a good deal of excellent advice, entirely worthy of the author of 'Principles of Mining.' Briefly, the appraisal of a mine depends upon two factors: the profit assured from ore in reserve and the probabilities of further profit from additional exploitation. The first, if an estimate be made by competent engineers, is reasonably certain; the second is essentially problematical. A mine may grow or at least maintain its vitality by finding ore either laterally or in depth. Usually the vertical development is the more important because it is less restricted. Imagination has free scope. For this reason expectations are apt to be exaggerated. Moreover, they may be stated in terms either intentionally vague or unintentionally misleading. Mr. Hoover suggests a unit of an additional hundred feet, which, in mines having levels 100 feet apart, is termed a 'lift.' Given an orebody of specified length, width, and richness, with a working cost accurately ascertained, it is possible to say that each successive 'lift' will yield a given profit. In most cases the assumption that the ore will persist for a hundred feet deeper involves but little risk, while the supposition that conditions will

men unchanged for an additional thousand feet would be a risk so big as to constitute a mere gamble. An engineer ought to be able to say whether it is safe to calculate on the lode persisting with little change for a hundred feet, but no engineer can say what will happen in the course of sinking ten times as deeply. Local conditions will give further guidance. Thus if the Great Boulder Proprietary is 400 feet deeper than its neighbour, the Ivanhoe, then the manager of the Ivanhoe, in the absence of special evidence to the contrary, is justified in assuming that the lode, such as it is, will continue without serious charge for at least another lift; in this case even two lifts might not be unduly optimistic. Obviously a lode that has persisted for 2500 feet is likely to continue for 100 feet more if the same lode or a member of the same system of lodes has been proved to persist to 2800 feet in an adjoining property. But if a vein has carried rich ore to a depth of 10 feet, and we count on similar ore for 100 feet deeper, then we stretch the probabilities. From actuarial tables it will be seen that an infant less than a year old has an expectation of life estimated at 41 years, while one that is 4 years old has an expectation of 51 years. At the beginning of its life the infant has to pass through sundry ailments before a future can be predicted with any confidence. Similarly a prospect, until it has reached below the water-level, is liable to vicissitudes as sudden as the whooping-cough that abruptly terminates the human prospect. Again, until the workings have penetrated from the oxidized into the sulphide zone, it remains highly uncertain whether a docile ore may not suddenly become refractory, just as a quiet child may unexpectedly develop a waywardness tending to kill the early promise of infancy. Thus we insist that a well developed mine and a prospect are not on the same plane of probability; inferences fully warranted by experience may be legitimate in one case and highly perilous in the other. However, if

directors, through the engineers in their employ, will tell the shareholders what net profit is to be derived from ore already proved, and supplement this figure with a statement of the amount of profit estimated in a further lift of 100 feet, they will afford the data necessary for sane speculation.

Waihi Geology.

When the shareholders read the report cabled by Mr. Richard and were informed that the impoverishment of the lode might point to "a zone of poor ore occurring between hydro-genetic and pneumato-genetic ore," they must have felt as if they had been struck by a golf-ball in the middle of the forehead. We venture to heal the wound by offering a little sedative explanation of terms so little known among laymen. In the first place, it is likely that a typographical error has been made, for the correct term to put alongside pneumato-genetic is not hydro-genetic but hydato-genetic. It sounds worse, but it really is not. The one term refers to ore deposits of aqueous origin and the other to those of gaseous origin, or, to be more precise, both cover deposits formed by the emanations given by intrusive masses of igneous rock, but in the one case the prime agent is supposed to be the heated gases and vapours that attack the rocks through which they pass so as to induce chemical changes culminating in the formation of ore, while in the other case the chief factor is the water heated by an igneous intrusion or the aqueous solution that represents the last phase in a protracted process of magmatic segregation. If the gaseous action takes the form of vapour escaping through clefths at the surface it is called fumarolic, as distinguished from the deep-seated activity to which the term pneumatolytic is confined. A fissure or fracture that becomes the channel for the passage of such vapour is marked by the changes produced on the adjacent country rock, which may become so

enriched by valuable minerals as to constitute a lode. Among the ore deposits believed to originate from partly gaseous rather than purely aqueous action are tin veins, such as those of Cornwall, in which are found cassiterite, fluorite, and other minerals that could be formed only by abundant gases. Copper veins containing tourmaline or topaz and gold lodes characterized by garnet, epidote, or actinolite are considered to belong to this class. Also cinnabar deposits. On the other hand the purely hydro-genetic or water-formed deposits exhibit the effects of chemical action involving no gas, but only hot water under pressure and charged with compounds able to replace the constituents of the rock traversed. Thus limestone is replaced by quartz, the feldspar of granite becomes sericite, hornblende is changed to chlorite, biotite may be converted into calcite, galena replaces calcite, pyrite succeeds sericite, native copper takes the place of zeolites and of feldspar. The chemical interchanges are multitudinous and diverse. Hence the line between the two classes of deposits is not often clear; on the contrary, in most cases the evidence suggests the combined action of both the watery and the gaseous emanations, so that authoritative geologists place a large portion of the ore deposits now being profitably exploited in a class to which the action of both gas and water is ascribed. The important type of deposit found at or near the contact of intrusive igneous rocks is an example of the effects of metamorphism due to the action of water above the critical temperature, that is, above 365°C , and subject to a pressure of more than 200 atmospheres, under which conditions water can only exist as a perfect gas. But here we reach a point at which scientific opinion is not unanimous. Indeed we may say that the whole theory has only recently become more than a reasonable conjecture and therefore it fails as yet to give the miner the definite guidance for

which he asks. We venture to say that the introduction of such abstruse problems into an explanation of the impoverishment evinced by the deeper workings of the Waihi mine is a mistake, for it tends to obscure rather than to illumine the vital problem on which the future of the mine must depend. The question is: What has caused the impoverishment? Mr. Williams mentions a change of rock. That is a common cause for sudden decrease in the richness of a lode. What is the rock that is associated with this change, how does it differ from the rock of the upper workings, and what is its position in the local geology? Is this rock likely to be succeeded by the formation in which rich ore has been mined or is it likely to persist so deeply as to extinguish hope of improvement? Other questions arise: Is the change due to mechanical conditions, such as a decrease in the fissuring along which the lode-channel was formed; or is it chemical, and due to lesser solubility of the rock? Do the minerals, other than gold and silver, in the ore of the impoverished zone differ from those associated with the precious metals in the upper levels; if there be any change, does the difference indicate the absence of secondary enrichment and the penetration of the workings into primary ore inadequately concentrated by nature? One fact stands out strongly, and that is the heavy flow of water at the 1000 ft. level. Is this water merely the drainage from overhead or does it indicate that the mine has not yet been extended below the water-zone, which is a horizon often identified with the generous distribution of ore? The persistent wetness of the mine appears to us to be favourable evidence, for it proves that the ground is liberally fissured and that the conditions congenial to the circulation of mineral-bearing waters continue to exist. But this fact needs to be examined in all its bearings before its scientific significance can be affirmed. In short, no comfort

can be derived from the use of expensive machinery. In other terms, it is a condition and not a theory that confronts the shareholders of the Waihi Gold Mining Company.

Progress on the Rand.

The annual address of the President of the Transvaal Chamber of Mines usually warrants a careful reading. The President at this time is Mr. J. G. Hamilton, who appears to be a man well worthy of occupying so responsible a position. His statements carry conviction and exhibit a breadth of intelligence highly impressive even to those who have not the pleasure of his personal acquaintance. Certainly his remarks are vastly more informing than the platitudinous utterances of other supposed leaders of the mining industry to whom the public vainly looks for guidance in matters so closely touching the pocket nerve. We give herewith the salient statistics contained in the official review published by the Chamber of Mines.

	1909	1910
	1909	1910
Rand.....	21,432,541	20,543,759
Tube-mills at work.....	175	136
	1909	1910
Rand.....	£30,703,912	£29,900,359
Value per ton.....	28s. 8d.	29s. 1d.
Cost per ton.....	17s. 8d.	17s. 3d.
Profit per ton.....	10s. 8d.	11s. 7d.
Total profit, Transvaal,	£11,567,095	£12,074,302
Rand	£11,216,105	£11,794,376
Total dividends, Transvaal	£9,119,858	£9,504,621
Rand	£8,876,085	£9,310,751

Referring to the results thus summarized, Mr. Hamilton places emphasis on the fact that the gold mining industry of the Transvaal is still gaining in relative importance, for while in 1895 the local gold output was 21% of the world's total, in 1905 it grew to 27%, and in 1910 to 34%, or more than one third of all the gold produced. He proceeds to show that while in 1909 the total working cost represented 60% of the value of the output, the dividends accounted for 31%, and the profits tax, loan interest, and capital expenditure together absorbed 9%, in 1910 the cor-

responding figures were 62%, 29%, and 9%. Thus the cost last year cut into the dividends. This was due to insufficiency and inefficiency of labour, one of the results being inability to keep the mills going to full capacity. In 1909 costs were unwarrantably lowered on some properties and 1910 therefore had to bear an increased expenditure for reconditioning the mines. It is believed that the average yield of 28s. 8d. per ton last year will tend to diminish, though this tendency will be retarded by the output of the City Deep and Randfontein Central mines. As regards working cost, it is hoped to reduce this item to 17s., but that is quite as much as can be expected. Even this is possible rather than probable, for it is held that the exacting demands of the Mines Department, coupled with higher native wages, will preclude any reduction. It will be noted that the aggregate working profit on the Rand in 1910 was £11,216,105 as against £11,794,376 in 1909, so that there was a decrease, despite the larger output of gold amounting to a gain of £800,000. The tonnage treated was 888,782 more. An increase of capacity was to be expected from the 47 additional stamps and the 36 new tube-mills, but improvement was checked by lack of sufficient labour. We note with interest that 25,376 white men were employed at the end of 1910 as against 23,126 a year earlier; and in the same period the number of apprentices increased from 418 to 521. Mr. Hamilton says, with evident feeling, that these figures "constitute the industry's reply to the irresponsible demand of a few theorists for the curtailment of the unskilled native labour force." He deems it inexpedient and impracticable to accelerate the employment of Europeans beyond the efforts now being made. He speaks hopefully of the more general use of rock-drills as a factor in overcoming lack of labour, and he refers with satisfaction to the experiment to be made at the Wolhuter mine,

where arrangements are being made to train white lads. This experiment, it is expected, will provide an increasing number of trained miners from among our own people. Among other efforts to improve conditions underground, he instances the general use of dust-arrestors and the pains taken to better the ventilation, sanitation, and general conditions under which employees live. Finally, he expresses his confidence in the good-will of the Government and the fairness with which the reasonable demands of the mining industry are being treated by the Ministers of the Union of South Africa.

Mining Speculation.

It has become the fashion lately among those profiting from the vagaries of speculative excitement to deplore the inanition of the share markets, and to regret changes that have lessened the fascination of dealing in mining scrip. That fascination has suffered, they say, by turning a speculation into an investment, by giving a security and stability in marked contrast to the risk and variety that formerly proved so alluring to the public. Concerning the leading South African mines especially it is said, almost in a tone of complaint, that market changes are slight and infrequent, the industry of the Rand is so solidly established as to be immovable, and the traffic in shares is so little affected by the ordinary vicissitudes of mining that it has become monotonously dull; all of which is, of course, far from the truth. Yet it is a view widely held and is worthy of examination. With that purpose we publish a list of the principal mines quoted on the London market, as recorded in Mathieson's 'Highest and Lowest.' The share quotation on the first day of the year 1910 is contrasted with the similar quotation on the last day of the same year, and to these we add the highest and lowest quotations during the year. To measure the extent of the fluctuations we append the dividends that were paid, not de-

clared, during the twelve months. The maximum and minimum prices are taken from actual transactions as recorded, and there is no means of knowing whether the Stock Exchange was buyer or seller. Where no actual transactions are available for these highest and lowest points, the daily closing quotations have been taken; in such cases the probability is that the highest is when the Stock Exchange is seller, and the lowest when it is buyer. In a number of cases the quotation is nominal and does not represent any business. It must be remembered that the Stock Exchange quotation is a double one: buyer and seller. A share may be quoted, for example, at $5\frac{1}{8}$ - $5\frac{3}{8}$; this means that the market will buy at $5\frac{1}{8}$ and sell at $5\frac{3}{8}$, the difference representing the jobber's 'turn.' In addition the speculator has to pay a commission varying according to the size and nature of the transaction. Probably 10s. per hundred pounds is an average tax as paid by the client to his broker.

Before going further it will be well to distinguish between 'investment' and 'speculation.' Confusion of thought in this regard is responsible for much of the unintelligent use of money on the share market. The 'investor' buys for the income or interest that will accrue therefrom, making proper allowance for amortization; the 'speculator' buys on the chance of a rise or fall in the quotation. The occasional variations in the price of an 'investment' are relatively small, and they tend to come back to a steady level, so that the main feature of this use of money is the yield in dividends; but the 'speculation' is expected to exhibit differences of price so large as to be more important than the interest paid, which then become incidental to the enhancement of the principal. Hence the ideal investment can be put away in a safe and left there without worrying about the vagaries of the market; it is usually bought outright, as compared to a speculation, in which temporary ownership is obtained by part payment, pending a careful

and 0.00 for the fluctuations. An investment supposes a minimum of risk and a small income return; a speculation involves a big risk, compensated by the possibility of a large gain. Most people are willing to call their speculation an investment and act accordingly, foolishly; not many call an investment a speculation because that indicates an excess of caution so rare as to be abnormal.

Much the most important and most stable market is that in Kaffirs, the name given to mining companies on the Witwatersrand. In this department we ought to find the rigidity of which the superficial complain, and it is here we ought to find the steady prices desired by those who wish to see the investment aspect of mining increasingly emphasized. We find little to encourage such hopes and fears. The soundest mining enterprises of the modern world are the big consolidations and holding companies on the Rand, such as Crown Mines, Rand Mines, East Rand Proprietary, Modderfontein, and Randfontein South. Are they a proper repository for the funds of widows and orphans; are they the gilt-edged shares to be selected by a punctilious trustee? Look at the record. Crown Mines fluctuated between 7'81 pounds and 9'06 pounds, representing a variation £1'25, as against a dividend of 0'65, or 13 shillings. East Rand ranged between 4'87 and 5'87, or 20s., as against a dividend of 8s. in the year. Modderfontein was as low as 11'06 and as high as 14'31, this being a difference of £3'25 or 65 shillings, as against a dividend of 10s. Randfontein South swung between 2 and 2'69, or 13'8 shillings, with a dividend of 3'5s. Rand Mines fluctuated between 8'19 and 9'65, or £1'46, representing 29'2 shillings, against dividends of 13s. Thus in every one of these especially substantial undertakings, the fluctuations during the year exceeded the amount of dividends paid; in other words, the man who bought to profit by the rise or fall in the quotation would apparently have done better

than the man who bought the shares on their income-bearing power. But this supposes that the speculator bought at the bottom and sold at the top, which is rarely the case. Moreover, 'in and out' buying and selling entails the payment of many brokerage fees, which, cumulatively, may become a serious tax even on a series of successful speculations. Therefore, the variation must largely exceed the dividend before we can conclude that betting on the one is more profitable than holding for the other. These big South African consolidations exhibit more sensitiveness to outside influences than might have been expected, but it will be noted that Crown Mines, East Rand, Modderfontein, and Randfontein South were quoted at practically the same figure at the beginning and the end of the year. A trustee who invested trust funds in them could afford to disregard temporary mutations and keep his eye on the steady payment of interest on the capital invested. That represents the best approximation to an investment in mining. In such a case the average man would do better by buying and holding, drawing his dividend regularly, than by trying to make a big profit by taking advantage of changes in the quotation. On the other hand, those in control of the management and in close touch with the market could make more money by buying on a drop and selling on a rise. But only the few who are accurately informed could expect to be successful in such financial gymnastics. However, these four or five splendid mining enterprises are exceptional. Undoubtedly to them we owe the idea that speculation has been killed on the Rand. This is easily disproved. Look at Bantjes, Ferreira, and Nigel. In each of these cases the quotation has been halved during the year and the dividends are relatively insignificant. The man who bought them for dividends and a safe investment would have been badly fooled, while the speculator for a fall could have made a fortune. Unfortunately the big variations

FLUCTUATIONS IN MINING SHARES

Name of Mine	Jan. 1, 1910	Highest during 1910	Lowest during 1910	Dec. 31, 1910	Dividends during 1910	Name of Mine	Jan. 1, 1910	Highest during 1910	Lowest during 1910	Dec. 31, 1910	Dividends during 1910
TRANSVAAL						AMERICA.					
Bantjes ..	£2 75	£3 25	£1 00	£1 87		Alaska Treadwell	£6 50	£8 87	£6 31	£8 75	17s. 6d.
City Deep	4 25	4 94	3 94	4 25		Alaska United	2 00	3 44	1 44	3 75	3s.
Crown Mines.....	8 12	9 06	7 81	8 12	13s.	Alaska Mexican ..	3 37	4 44	3 12	3 50	8s.
East Rand	5 50	5 87	4 87	5 12	8s.	Anaconda	11 00	11 22	7 34	8	8s. 4d.
Ferreira	19 50	19 75	9 44	10 00	80s.	Mexico Mines	6 37	9 87	6 37	7 75	17s. 6d.
Ferreira Deep.....	5 62	6 12	4 75	4 87	11s.	Amalgamated Copper	\$92 12	\$92 12	\$60 00	63 75	6s. 3d.
Modderfontein	11 50	14 31	1 06	12 00	10s.	Arizona Copper	45s.	48s.	34s. 6d.	35s.	2s. 6d.
Nigel ..	2 8	3 06	1 25	1 75	6s.	Camp Bird	29s.	33s. 6d.	26s.	32s.	4s.
Randfontein South.	2 1	2 09	2 00	2 12	3s. 6d.	El Oro	27s.	29s. 9d.	25s.	25s.	3s.
Rand Mines	7 20	9 65	8 19	8 62	13s.	Esperanza	60s.	63s. 9d.	33s.	40s.	5s. 6d.
Robinson	10 75	11 12	9 35	10 00	30s.	Mountain Copper	50s.	48s. 9d.	32s. 6d.	32s. 6d.	3s. 7½d.
Robinson Deep.....	8	4 12	2 87	3 50	5s. 6d.	Famatina.....	20s.	22s. 6d.	6s. 10½d.	11s.	
Summer & Jack	1 75	1 87	1 44	1 62	3s. 6d.	Palmarejo	4s. 6d.	8s.	6d.	1s.	
RHODESIA.						St. John Del Rey	16s.	18s.	13s.	14s.	1s. 8d.
Enderby	£3 57	£4 18	£2 94	£3 25	6s.	San Francisco del Oro	15s.	21s. 6d.	8s.	14s.	
Enterprise	3 75	3 94	2 18	2 62	4s.	AUSTRALASIA					
Giant	0 00	5 44	5 44	4 50	3s.	Broken H. Block 10..	£3 75	£3 87	£1 75	4 18	8s.
Globe & Phoenix ..	1 07	0 00	1 14	1 00	4s. 6d.	Broken Hill Prop.....	42s.	45s.	32s. 6d.	35s.	8s.
Rhodesia Exploration	2 50	4 25	2 18	3 25	4s.	Broken H. Block 14..	11s.	11s.	5s.	5s.	1s.
Selukwe Columbia	1 37	4 00	1 37	3 75		Sulphide Corp.....	20s.	24s.	16s. 6d.	21s.	1s. 6d.
Tanganyika	5 7	7 37	5 39	6 25		Zinc Corporation.....	11s.	14s. 9d.	10s. 6d.	13s.	
Battlefields	10s.	15s.	2s. 6d.	3s. 9d.		Bullmen		£3 50	£1 56	£2 62	
Garka ..	17s. 6d.	49s.	16s. 6d.	32s. 6d.		Great Cobar	£6 28	£6 70	£ 05	£5 50	
Loma Stroussell		50s.	12s. 6d.	22s. 6d.		Mount Boppy	2 12	2 69	1 44	2 50	6s. 6d.
Penhalonga	3s. 6d.	6s.	6d.	15s. 1		Mount Morgan	3 50	4	3 31	5	4s.
Selukwe	6s. 6d.	25s. 6d.	3s.	5s.		Waihi	9 50	10 06	4 62	4 75	18s.
Surprise	9s.	75s.	6s.	25s.		Brilliant	6s.	7s.	3s.	5s.	3d.
Wanderer	4s.	11s. 6d.	8	8s. 6d.		Briseis	8s.	8s. 6d.	5s.	6s.	1s.
WEST AFRICA						Mount Laxell	37s.	39s.	30s.	48s.	3s.
Abosso	£2 00	£2 94	£1 75	£2 00	8s.	WEST AUSTRALIA.					
Ashanti Goldfields..	2 00	2 34	1 87	2 00	3s.	Golden Horse-Shoe..	£7 25	£7 75	£4 00	4 11	5s.
Champion G. R.	1 62	3 94	1 25	1 75	5s.	Ivanhoe.....	8 25	9 00	6 50	6 75	24s.
Cinnamon Bippo....	2 87	2 94	1 12	1		Kalgoorlie	7 25	7 57	6 00	6 25	25s.
Abboniakoon	13s.	15s.	8s.	9s.		Sons of Gwalia.....	1 75	2 00	1 44	1 67	6s. 3d.
Bibiani	12s.	17s.	6s.	7s.		Associated.....	19s.	19s. 6d.	8s.	8s.	
Broomassie	9s.	11s.	6s.	6s.		Great Fingall.....	16s.	19s.	10s.	15s.	1s.
Protea Block A	35s.	38s.	29s. 6d.	33s.		Oroya Black Range..	12s.	13s. 6d.	8s.	10s.	1s.
INDIA & MALAYA						South Kalgorlie.....	16s.	16s.	9s. 6d.	10s.	2s.
Mysore Gold	£5 00	£5 94	£5 12	£5 25	1s. 6d.	Great Boulder Prop.	23s.	24s. 9d.	19s. 4½d.	20s.	2s.
Champion Reef ..	10s.	10s. 3d.	7s. 6d.	9s. 6d.	6d.	SIBERIA.					
Nundydroog	28s.	39s. 2d.	27s. 9d.	33s.	4s.	Lena Goldfields..	£1 8s.	£1 1	£1 84	£ 04	2s.
Ooregum	22s.	27s. 3d.	14s. 9d.	15s.	3s.	Spassky.....	2 50	4 1	3 0	3 75	2s. 6d.
Balaghat	4s.	6s. 6d.	2s. 6d.	2s. 6d.		Orsk Goldfields...	2s.	3s. 6d.	3d.	2s. 6d.	
Gopani	£1 75	£3 37	£2 75	£ 57	8s.	Atbasar	21s. 3d.	27s. 6d.	21s.	27s. 6d.	
Pahang	9s. 6d.	10s. 6d.	4s.	4s.		Kvshtim	23s.	31s. 3d.	22s. 6d.	31s. 3d.	
Pusing Lama	9s. 6d.	10s.	2s. 6d.	6s.	6d.	EUROPE					
Trench	34s. 9d.	38s. 9d.	23s. 9d.	36s. 3d.	5s.	Red Earth	£79 00	£79 69	£63 62	£69 00	55s.
						Tharsis	6 25	6 37	5 25	5 50	5s.
						Mason & Barry ..	2 87	0	1 80	2 87	5s.
						Dolcoath	16s.	17s.	12s. 6d.	16s.	6d.
						South Crofty	40s.	32s.	20s.	25s.	4s. 6d.

*Not formed

New Shares

of Kaffirs are mainly downward, for the Rand has reached its zenith, and when the unexpected happens it is usually unpleasant. Next comes the Rhodesian market. Here we get lots of fun for our money. Eldorado is comparatively steady, ranging from 2'94 to 4'18, a difference of £1'24, being 24'8 shillings, as against a dividend of 6s. Enterprise rose to 3'94 and fell to 2'18, a range of £1'76 or 35'2 shillings, which is large as compared to a dividend of 4s. Giant exhibits a maximum difference of £2, with a dividend of 3 shillings. Here the speculator has much the best of it. The 5s. shares of the Globe & Phoenix soared from £1'83 to £3 during a period when the total dividend was 4½ shillings. Rhodesia Exploration exhibits a range of over £2 with a little dividend of 4s. Tanganyika, with the iridescent promise of a dividend but no actual distribution of profit, ranged from 5'50 to 7'37, but even this may be regarded as steady when compared to the Battlefields, from 15 to 2½ shillings, to Gaika, from 16½ to 49, to Penhalonga from 6 shillings to 6 pence, Surprise from 25½ to 3 shillings, and Selukwe from 25½ to 3 shillings. The more erratic of these shares had no compensatory dividends, so that in this department of mining activity it must be confessed that the invincible optimism of the gambler, especially a 'bear,' found a better field than the cold discrimination of the mythical investor. Yet in this department the big movements were not all downward, the mines first mentioned having been boomed successfully on the expectation of expanding production. The bloom is not yet off the Rhodesian peach, but if we mistake not the public will find a hard stone when it bites greedily. This is a highly speculative market and one to which the term 'investment' can only be given in cynical derision. Lots of money will be made and lost, but not by looking to a return of interest on the capital involved. The Indian mines, which are considered anything but spectacular, show ample

variations, far greater than their dividends. Yet this group is comparatively steady. The American group is anything but lifeless. Even the large and steadily productive low-grade mines of the Treadwell group exhibit wide divergences of quotation. The Alaska Treadwell ranged between 6'31 and 8'87, or £2'56, while 7½ was paid in dividends. The Alaska United quotation was doubled, from £1'44 to 3'44, while only 3 shillings was paid, and the Mexican exhibits a range of £1'32, with a dividend of 8 shillings. Of course, Anaconda is a highly speculative stock, so that a range of £3'88 is not remarkable, though it is 9 times more than the dividend paid during the year. Amalgamated Copper is the biggest gambling counter on the world's mining markets; in 1910 it only fluctuated between 60 and 92 dollars, or £6, as against a dividend of 6s. Mexico Mines has been the subject of a fiasco; hence a range of £3'50 is not surprising, although the dividend is only 7½. Even such substantial and conservatively managed mines as El Oro, Camp Bird, St. John del Rey, and Arizona Copper, all exhibit changes of price exceeding the amount of the dividend. The El Oro is the most steady, for a maximum range of only 4s. 9d. accompanies a dividend of 3 shillings. This share simulates the behaviour of an investment. Palmarejo, San Francisco del Oro, and Famatina, are lively speculations, if one may judge from the wide differences of quotation and the absence of dividends, which are still in the blue-gray of the distance. Of course, we expect some fun for our money in Australian mines; there we can get all the excitement that the Rand is said, by ill-informed persons, to lack. Mount Morgan is steady, for a range of 12 shillings is coupled with a dividend of 4. Mt. Lyell varies 9 shillings with a dividend of 3. The Broken Hill group is affected by labour troubles, oil-process litigation, and the base-metal markets; therefore dividends of 1, 2, and 5 shillings go with share fluctuations of

6, 12½, and 42 shillings, respectively. The Waihi and the Bullfinch represent losses and gains of a stupefying character, although another year may add an even more exciting chapter to the story of both. Of course, a dividend of 18s. on a share that drops £5, is as negligible as the absence of a dividend on a new mine having 500,000 shares that rise to £3½ on the statements of its owners. The Kalgoorlie group must have made a few people walk the floor, the rises and falls being large enough to make the dividends look absurd. Golden Horse-Shoe's 5s. dividend seems like adding insult to the injury of those whose shares have dropped from £7¾ to 4. Even the shares that have fluctuated least exhibit a range far exceeding the amount of the dividends. The Siberian group appears able to give the speculator a run for his money: it represents a stage of expansion, for in this case the movements have been mainly upward. West Africa has had its boom and expects another; therefore the fluctuations are not remarkable, but they confirm the general observation that dividends are subordinate to market movements. Finally we come to a few of the old European mines and find that the same deduction holds good. Even Rio Tinto, an investment if there ever was one in mining, shows dividends of 55s. as against a difference in quotations of not less than £16. The story is the same throughout.

An obituary is a useless performance unless it helps the living to better endeavour. We have not reviewed the facts in this case merely to accentuate a gloomy aspect of the mining business. The recognition of realities ought to be illuminating. It is true that Spencer's idea of a tragedy was a lovely theory killed by an ugly fact, and to this extent we deem the theory of profit to be made from mining dividends as, in the main, a fallacy that needs to be punctured. The profit made in mining is made on the rise and fall of shares, the public being usually a bull and the profes-

sional operator a bear, just as in horse-racing the public backs a favourite, while the book-maker gives odds against any single horse and backs the field. The man that backs an individual horse for each race will generally come to grief sooner or later. This is true of the man who supposes himself to be an investor and buys mining shares on the expectation of an adequate return in dividends, especially if he buys them when they are at a premium, that is, after the insiders have bought all that they want at par or at an underwriter's discount. The only time when the public has a fair chance is when a young mine is brought out by a firm of high character and endorsed by engineers of approved reputation. Then if shares are acquired at par or thereabouts, the purchaser has much in his favour, especially two factors: the expanding character of a young enterprise and the inevitable future exaggeration of its value. All good mines are eventually over-valued, and the richer they are the greater the tendency to disregard caution in appraising them. They are considered so exceptional as to be superior to ordinary standards. That is why more money is lost, by the public, in rich mines than in poor ones. The latter rarely soar far enough to fall far, except when deliberate trickery is perpetrated. Young and expanding enterprises can carry a heavy load of capitalization, and if the speculator is content with a moderate winning he need not take excessive risk. Those who bought shares in the big mines of the world at par have, of course, seen a lordly increment to their capital investment, and it was an investment in so far as they obtained a handsome income and a return of their capital. But even in these cases the man who did not hold on to the bitter end, who subordinated interest to enhancement of principal, who speculated instead of investing, did better still. It is said that the authorities of the Stock Exchange do not ring a bell when a rise in shares is ended.

METAL MARKETS

COPPER.

Average prices of cash standard copper :

February 1911	January 1911	February 1910
£55. 1s. 7d.	£55. 14s. 3d.	£59. 10s. 6d.

The record for February is one of dullness. The speculative interest has died out of the market and the turnover on the metal exchange has been of small dimensions. The present level of prices is considered too low for bear operations and the course of events affords little to encourage bulls. The statistical position is colourless, for while on this side of the water stocks continue to show a slow but steady decline, on the other side in spite of a substantial fall in production a disconcerting increase in January of no less than 9000 tons is announced. Trade buying in Europe, especially in Germany, continues at high water mark, and every fall in prices is immediately followed by renewed purchases. Manufacturers have been buying as far ahead as June. In the sulphate of copper trade, which is now in full swing, activity is pronounced and large quantities of Chili bars are going into consumption. Makers are sold out for some months ahead and the price of the sulphate has risen considerably.

American advices speak of the growth of a more hopeful under-current of sentiment. General attention is directed to the progress of events and the apparently improving economic conditions there. Good grounds seem to exist for such optimistic feeling in the removal of questions which are a bar to the development of trade.

TIN.

Average prices of cash tin :

February 1911	January 1911	February 1910
£189. 12s. 10d.	£187. 17s. 11d.	£149. 13s. 0d.

The fluctuation in this market has been rapid and bewildering. Nervousness among bears was responsible for a rise to £204 in the early days of the month, but in a week the price dropped to £171; in two days a fall of £14 was registered. The support given by the syndicate has been alternately removed and re-applied in the most erratic fashion, the leading operators being at one moment aggressive sellers and heavy buyers the next. It is quite impossible to take any intelligent view of prices. So far as the

position affects prices consumption is excellent and stocks show a steady decline. In the East holders who have sold well are very reserved, and America continues to buy freely. The requirements of the tinplate trade show a rapid expansion, especially in America where new mills are being put into operation. Estimates of shipments during the coming month are moderate. The situation however has been complicated by the vagaries of the leading dealers.

LEAD.

Average prices of soft pig lead :

February 1911	January 1911	February 1910
£13. 1s. 11d.	£13. 0s. 8d.	£13. 7s. 2d.

This market is now in a sound position. Consumers have refrained from buying for over two months and must have reduced their stocks very substantially; the nature of their enquiries which are all for prompt delivery indicates this. The amount of unsold lead imported has decreased noticeably and prospects are considered favourable.

SPELTER.

Average price of good ordinary brands :

February 1911	January 1911	February 1910
£23. 3s. 9d.	£23. 16s. 9d.	£23. 3s. 1d.

Demand has not been great and the tone is dull. The galvanized iron trade is reported as better, and the brass trade is well employed, but the improvement is not reflected in any increased demand for the metal. No change has taken place in the syndicate price, but dealers have been making concessions, and a relapse took place about the end of the month.

OTHER METALS AND MINERALS.

Prices quoted on March 10 :

SILVER.—24½d. per oz.

PLATINUM.—166s. per oz.

BISMUTH.—7s. 6d. per lb.

ALUMINIUM.—£67 per ton.

NICKEL.—£167 per ton.

COBALT.—9s. 9d. per lb.

ANTIMONY.—£32 per ton.

QUICKSILVER.—£10 per flask of 75 lb.

MANGANESE ORE.—8d. to 9d. per unit (1%).

IRON ORE.—Cumberland hematite 20s. per ton at mine. Spanish 21s. 9d. delivered in England.

PIG IRON.—Cleveland 48s. 9d. per ton. Hematite 66s. per ton.

WOLFRAM ORE.—35s. 6d. per unit (1%).

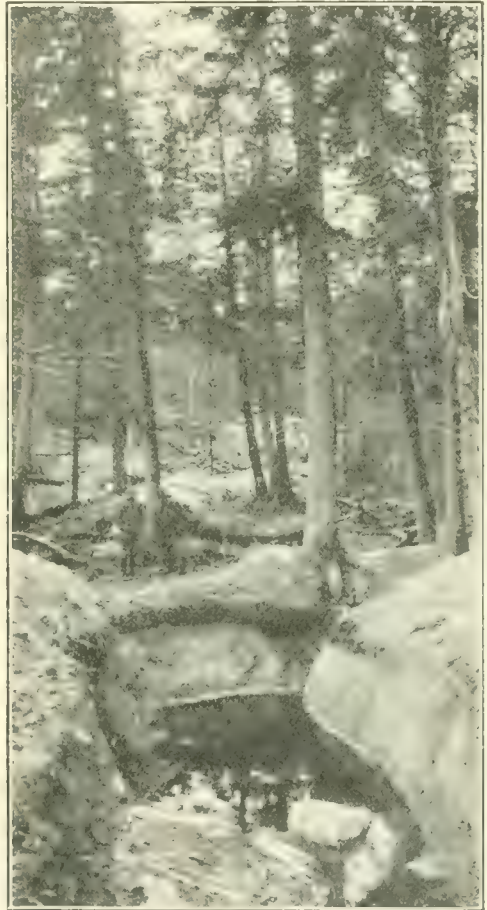
SPECIAL CORRESPONDENCE

News from our own Correspondents at the principal mining centres

TORONTO.

Porcupine.—Interest in this district has been considerably increased and speculation encouraged by several recent events. The Porcupine end of the branch railway connecting the camp with the Temiskaming & Northern Ontario has been definitely determined. The road will come in north of the lake, running down the southeast shore and terminating near its south end about one mile from the Dome property. The work is being vigorously pushed, despite the fact that there is several feet of snow on the ground, by a force of about 700 men, and good progress is being made in laying the rails. It is hoped that the line will be in operation by midsummer. Now that the route has been settled many town-lots have changed hands and building is active. Experienced mining men from the West have been attracted by the growing fame of the camp, but the universal complaint of speculators is that prospectors are for the most part disposed to ask absurdly high prices for undeveloped properties, and to insist upon cash payments, instead of being willing to accept a comparatively small amount of ready money and the balance in instalments contingent upon the property proving of value. The prospectors are usually men without mining experience, and any discovery of importance in the neighbourhood of their locations induces them at once to demand increased prices. This tendency to exaggerate values has done much to retard investment and actual mining work. Prominent among American visitors was F. Augustus Heinze, of Butte, Montana, from whom great things are expected as he purchased the Foster property adjoining the Dome and has arranged for its development, placing R. Alvin Weiss in charge. Mr. Heinze's example is expected to attract a following. A yet more significant occurrence is the contemplated investment of a considerable amount of British capital by the Northern Ontario Exploration Co., recently organized by the London firm of Bewick, Moreing & Co., among the promoters being C. Algernon Moreing, the Earl of Errol, Sir William Bell, David Richards, and John Barry. A party representing the company has left England for Canada, and will shortly arrive at Porcupine, where they are anxiously awaited by numerous claim-owners.

In the meantime two engineers, Messrs Pope and Kuehn, have been quietly working in the district in their interest, investigating proper-



Trench across the Foster Lode, at Porcupine, showing the mass covering the surface.

ties for which they are likely to negotiate. At the Vipond mine, now operated by the Porcupine Gold Mines Co., in which Flynn Bros. of New York have the principal interest, the vein, 7 ft. wide, has been reached by a drift from the shaft at the 100 ft. level and a one-stamp mill is being worked. A 10-stamp mill is to be erected. The Scottish Ontario, which has a large orebody at the 100 ft. level, will put down another shaft on another vein north

of the main shaft. The Pearl Lake Gold Co., capitalised at \$1,500,000, has built a camp on the property, which has extensive surface showings, and will begin sinking at once. The Standard Porcupine Gold Mining Co. has two shafts down on their holding of 65 acres near Simpson Lake in South Tisdale and fine showings of free gold are reported. The Crown Chartered has signed a contract for 1000 ft. of diamond-drilling on their claims in West Tisdale. The Porcupine Exploration Co. has lately taken over a large number of claims including the McPortland & Morris locations in Tisdale; seven McKae claims in Whitney, near Bobs Lake; the James Ryan claims in Deloro; the three Lindberg claims in Tisdale; and the three Thompson locations adjoining the holdings of the Timminssyndicate. The same company has also secured five claims in the new camp west of Porcupine known as Cripple Creek. Flynn Bros. of New York have bought the Hughes claim to the north of Porcupine town for \$300,000 and started stripping.

Porcupine prospectors are strongly in favour of a change in the provisions of the mining law with regard to assessment work. At present the prospector staking a claim late in the autumn is obliged to do 30 days assessment work during the ensuing three months. Much of this work has to be done when the winter has set in and consequently consists largely of clearing away snow, and any real development is done under great disadvantage. It is urged that the winter should be made a close season and the work limited to eight months of the summer and fall.

C. A. Moreing and party have arrived and it is announced that extensive transactions have been effected. Bewick, Moreing & Co. have taken over for development 50 of the claims held by the Timmins, McMartin, and Dunlop syndicate, not including the Hollinger and Miller-Middleton group. Engineers will go to work at once and at least \$500,000 will be spent in development. At the Hollinger, the orebody is proved down to 200 ft. for a total length of 1200 ft. on one vein. Latterly the stock has shown an upward tendency, selling at over \$6. On the Rea mines operated by the Consolidated Goldfields diamond-drilling shows free gold at a depth of 200 ft. The Preston East Dome Co. has let contracts for the sinking of four shafts and has ordered a stamp-mill.

Cobalt.—Operations have been checked by an accident to the power system, causing a shortage of compressed air and resulting either in suspension or curtailment of work at many

of the mines. This has caused some decrease in January shipments and in those for the earlier part of February, but the difficulty has now been overcome. La Rose continues to improve its position, a statement issued showing cash in hand and value of ore in transit and at smelters on January 20 to the amount of \$708,470, in addition to ore sacked for shipment \$305,343. The available cash assets have been increased over 65% since October 1. The annual statement of the Crown Reserve, presented January 25, showed profits of \$1,185,100, and \$1,080,647 distributed in dividends, which after deducting \$19,359 expenses of operating the Silver Lake leasehold, left a surplus of \$659,986. The profits were equal to 67% earned on the capital. Some rich ore is being opened up on vein 14 at the 200 ft. level, the vein, at first quite narrow, now showing 2½ in. of high-grade ore. The Beaver has cut a station at the 350-ft. level and the shaft is being put down to 400 ft. A rich ore-shoot 11 to 16 in. wide has been encountered on the 300-ft. level and opened up for 30 ft. The annual report of the Trethewey for last year shows total receipts of \$437,562 and a net revenue of \$237,800. Capital assets have been increased by \$67,781. The total production was 865,777 oz. silver. The concentrating mill, which has only been in operation since last May, treated 19,103 tons of ore producing 263 tons of concentrate. The annual report of the McKinley-Darragh showed silver recovered to the value of \$1,426,856 and a net profit of \$983,043. The ore in reserve amounted to 6,041,500. The Temiskaming is in good ore at 540 ft., the deepest working in the camp. The 500-ft. level was disappointing, showing nothing equal to the rich ore of the upper levels, but a winze found good ore at a depth of 40 ft. The stock market is beginning to show some signs of activity and several of the dividend-paying shares and others likely to enter that class have lately appreciated under the influence of favourable reports.

Railways.—On February 15 an influential deputation interviewed Sir James Whitney and other members of the Ontario Government with the request that a branch railway of about 40 miles should be constructed from Charlton on the Temiskaming & Northern Ontario railway to Elk Lake and Gowganda. It was urged that the Gowganda mines had accumulated large quantities of low-grade ore, which could not be shipped at a profit without railway transport. As an alternative proposition, in case the Government did not see their way to

build the road as a public undertaking, the deputation asked them to grant a charter to private parties, coupled with the provision that the Government would not at any future time build a competing road. The replies of the Premier and the Minister of Mines were decidedly favourable in tone, but it was intimated that before the Government could give a definite answer they must have more detailed information as to the tonnage the mines would produce in case the road were built. A committee was appointed to obtain the required data.

JOHANNESBURG.

State Mines.—The work of opening up the Modderfontein Government areas (State Mines) is now well under weigh, and the four shafts are down from 100 to 220 ft. These shafts, 8 by 43 ft. clear, each with seven compartments, are placed so that two will cut the 'reef' at 2000 ft. and two at 3000 ft. The shaft-sinking is under the control of J. G. Lawn, and is on orthodox lines. In this area, once the dolomite is passed, rapid sinking is customary. The number of shafts being sunk in the Far East Rand is increasing rapidly, and the years 1912 and 1913 will see the results of the most critical development work it is possible to conceive in any part of the Rand basin. It is not often realized that the showing in the Springs, Brakpan, State Mines, Modder 'B,' Grootvlei, Modder Deep, and Geduld, must vitally affect the destiny of the Rand. It is stated that the sinking in progress on the State Mines is on 'orthodox' lines, that is, rectangular shafts widely distant, in contradistinction to the work on the Modderfontein Deep Levels, where companion shafts are being sunk, and on the New Modderfontein, where a circular shaft is going down in the eastern deep level portion of the property.

Tin Mining.—The influence of the great advance in the price of tin upon the tin mines of the Transvaal has not been as general as might be expected. Some of the richer properties, however, have come into greatly increased favour with speculators. The Zaaiplaats company, for instance, is a rich profit-making concern in the Waterberg district, the prosperity of which is, of course, directly and weightily influenced by the strength of the metal market. The mine made £20,000 profit in January and is 'good for' a bigger profit in February. It is also reported that a new 'pipe' or chimney of tinstone has been found in the granite, justifying an addition to plant. It is undoubtedly true that the remarkable

pipes worked on the Zaaiplaats are exceptionally persistent, and that elsewhere in the district far less satisfactory development results have been obtained in following similar deposits in depth. Little has been heard lately of the progress of alluvial tin mining in Swaziland, where the Corner House controls the principal workings. These, it is hoped, will be stimulated to expansion by the present high price. The Transvaal's production of tin during 1910 reached the creditable figure of £328,500 in value, or £100,000 in excess of the 1909 aggregate.

Crown Mines.—Impatient shareholders express disappointment at the result of the Crown Mines amalgamation, having anticipated greatly improved aggregate returns from the start. The true position will be disclosed



Prospecting near Oristad, North of Lindenburg.

at the annual meeting to be held on March 14, but it must be clear to all who are acquainted with the facts that the full advantage of technical fusion cannot be gained, in the case of five or six mines operated for a long time as independent units, without much labour and delay. The benefits of amalgamation are not to be seen in the unification of a few offices and stores. Centralization and the economic inter-relation of underground operations must always constitute the dominant factor. What this means on the Crown Mines may be gathered from the remarks of Alpheus Williams, the manager of De Beers, made during the recent visit of engineers from the Rand. He was emphasizing the vast importance of concen-

tration in the attainment of those hoisting records for which Kimberley has so long been envied by the Rand, and also of increased output. "The Crown Mines," he declared, "has realized this, and will in the near future be hoisting all its ore through two shafts instead of ten. Its new 7-compartment shaft now being sunk will be arranged with three main loading-boxes at depths of 2200 ft., 2800 ft., and 3400 ft. The hoisting will be done with three engines, each lifting 8-ton skips. With the two shafts on the Crown Mines it is proposed ultimately to hoist between 9000 and 10,000 tons per day. Probably no other shaft on the Rand has an output of more than 2000 tons."

Geological Society.—The annual meeting of the Geological Society of South Africa, held on January 30, resulted in the election of E. T. Mellor as President. This small society has been fortunate during recent years in being able to maintain a council of high scientific standing, although the number of men qualified for such distinction is far smaller than in the case of the Mining, Chemical, and Mechanical organizations. There is no society in Johannesburg more dependent upon its officers and a few other active spirits for its vitality. They are called upon not only to supply the geological mill with most of its good ore, but also to sort out the quantities of low-grade stuff contributed from the vast quarries of inexperience. In this mining country, geology proves a dangerously fascinating subject. Your local fishmonger does not worry you with his opinions of the modern ionic theory, nor does the postman delay in his rounds to dilate upon the applications of low-pressure turbines, but so popular is the 'science' of geology that there is scarcely a policeman within range of the New Club who is not primed with all the latest revelations of Rand stratigraphy. For the sobering influence of Mr. Mellor and his colleagues, let us be thankful. The election of this geologist as President is of double import for the reason that he is now engaged, as an officer of the Survey, upon the first detailed investigation of the Rand made by Government geologists. It has been the wise and generous custom of the Transvaal Survey to keep those interested in touch with their observations through the meetings of the Geological Society, thus affording publication of important results with greater promptitude than is possible through the agency of the usual annual reports and bulletins. Let us hope that Mr. Mellor will not be deterred from following precedent in

this regard for fear of subjecting his presidential chair to the bombardment of silly criticism, likely to arise in the local non-critical Press upon the pronouncement of his first judgment on Rand problems.

Mine Gases and Phthisis.—To the Rand mining man, the conclusion formed by the West Australian commission, that dust and dust alone is responsible for fibrosis, comes as a surprise. The question of miner's phthisis, its cause, prevention, and symptoms, has been discussed more thoroughly in the Transvaal during recent years than in any other part of the world. The report of the Transvaal Miners' Phthisis Commission and the discussion of Heymann's paper on 'Some Mine Gases' in 1903, revealed a general consensus of opinion, differing only in degree, that the carbon monoxide and higher oxides of nitrogen generated in mining practice have a vitally important influence upon the prevalence of the disease.

Venterskroon.—The prospecting of the Venterskroon (Vaal River) goldfield does not appear to have proceeded with the satisfactory results anticipated in some quarters. It is reported that the Consolidated Goldfields is ceasing to take an active interest in the area. The work being done by the Free State Banket Development Co. is particularly interesting, as it is geologically controlled by G. S. Corstorphine, best known to the outside world as joint author with F. H. Hatch of 'The Geology of South Africa.' It appears that Dr. Corstorphine is satisfied with the identity of certain beds in the Witwatersrand formation, so conspicuous in the Venterskroon district, with such well-known strata as the Orange-Grove quartzites, Water Tower slates, red slates, 'speckled bed,' and Hospital Hill quartzites, which underlie the Main Reef series at Johannesburg; also that the overlying Kimberley and Elsburg conglomerate series are represented.

New Mills and New Men.—The City Deep has been running 50 stamps and 4 tube-mills for some weeks, and a screen-assay of about 8 dwt. is reported. This figure corresponds with the ore-reserve estimate, assuming that the enrichment due to sorting is balanced by the inclusion of development rock. The actual yield of a new plant is, of course, of small importance. There have been further delays in the starting up of the Randfontein Central mill of 600 stamps, in spite of the presence of Sir J. B. Robinson himself. We are promised a start at half-capacity immediately. Results reported two or three months hence—and not before—will be of value. It

is reported that David Gilmour, chief mechanical engineer, is leaving the Randfontein group. The loss will be a heavy one. It is a remarkable fact that of the nine big groups of mines upon the Rand seven have experienced important engineering changes within the last few months. G. E. Webber of the Rand Mines will return to America at the beginning of April, and as previously recorded, W. W. Mein of the Eckstein Central Administration, J. H. Johns of Barnato's, Kopelowitz of Albu's, Morris of the East Rand Proprietary, and L. Simson of the Gold Fields, have all recently severed their connection with their groups, of which they were the first in technical control. The two lesser groups—Neumann's and Goerz—alone seem to have es-

appreciatively referred to in these columns (December 1909 and June 1910). There is and can be no suggestion of personal feeling in the matter—a point of considerable importance where criticisms necessarily appear unsigned. It is manifestly irrational, however, to speak of comments appearing in the notes by the regular and accredited correspondent of a widely read technical journal as a slap in the dark. That these columns stand under editorial responsibility should satisfy all who are not in search of personalities for weapons of reply. Mr. Johnson must recognize that public speaking is liable to bring him the penalty of annoying public criticism as readily as the reward of comfortable distinction and honourable fame.



THE CASON SLIME PLANT.

aped this dangerous wave of restlessness.

Personality in Discussions.—In a reply to discussion on his paper 'Efficiency of Labour Underground,' Mr. Tom Johnson has declared that your correspondent would have done better to have "attacked" him before the Society in open discussion rather than "given him a rap in the dark." The attitude adopted by Mr. Johnson is perplexing and unfortunate. Mr. Johnson takes a prominent part in Rand mining affairs and expresses his bold opinions with exceptional and commendable liberality. In the case in question the apparent weaknesses of his arguments were lightly ridiculed (October 1910), just as his public work and utterances have also been

NEW YORK.

Reciprocity with Canada has been recommended by the President and seems likely to be adopted before these lines reach the reader. It will be a return in part to the early policy of the two countries, and the new treaty marks a distinct reaction against the high tariffs of recent years. While the reduced duties apply mainly to grains and food-stuffs, the mining industry will be affected in certain important particulars. In the main the market for Canadian materials is enlarged. Felspar, fluor-spar, mica, talc, gypsum, asbestos, and other non-metallic minerals which the Dominion is prepared to mine and dress to advantage, will be admitted to the United States free or at

reduced rates. These concessions will stimulate both mining and milling in Canada. Coke is made reciprocally free, a measure that will greatly benefit the smelting industry of the Western United States. Iron ore is to come into the United States at 5 cents per ton in place of the present duty of 10 cents. This will stimulate the development of the Canadian mines in the Lake Superior region, but since their total output will for a long time be small, as compared with those south of the boundary, the mines of Minnesota and Michigan will not be harmed. By the time Canadian shipments are large, the United States will doubtless be glad to get all the ore that the Canadians care to let go. Even now the furnaces near Philadelphia draw ore from as far as Kiruna. Coal, under the new treaty, is to be admitted to Canada at a duty of 45 cents per ton of 2000 lb. and to the United States at 45 c. per 2240 lb. Practically, therefore, coal is on a reciprocal basis, though prices of foreign coal in each country will be artificial and the tendency will be for each country to depend as far as possible on local fuel. The coal situation is peculiar. Canada contains excellent deposits in the extreme east and west where adjacent parts of the United States have little or none. On the other hand the middle portion of Canada is largely without fuel, while the American States immediately to the south are abundantly supplied. The situation would seem to warrant a free interchange of products without any duties. Industry has, however, been built up on the basis of New England's fuel coming from the Appalachian States, and many railway lines have been constructed to serve the present course of trade. To change the whole matter at once is hardly possible. The present step may, however, be fairly considered as merely the first in a series that will lead to full reciprocity as to coal. The new treaty makes little or no change in the metal schedule. In that direction legislation of recent years has gone backward, a United States duty on zinc ore having been added to the one existing on lead. In the opinion of many informed students, both are now mischievous.

Alaska and its problems have been much to the fore at Washington lately, though the net result, measured in legislation, is likely to be small. Congress did increase, to \$100,000, the amount allotted to the Geological Survey for work in Alaska, thus recognizing the excellent work done by A. H. Brooks and his associates. The famous Cunningham claims are still in the stew, and no serious reform in the laws governing mineral lands is probable.

In the meantime Alaska worries along and business continues to grow. The Copper River & Northwestern railway will be finished from Cordova to the copper mines by March. Trains have been running from Cordova to Chitina since September last, and regular shipments from the Bonanza mine are soon to begin. The new railway is a trifle over 200 miles long and connects an important copper-mining region with the coast. The Bonanza, the leading mine, belongs to the Guggenheims, and is conceded to be an important property. Whether others of equal rank will be developed remains to be seen. If not, the railway is unlikely to prove a paying investment. There is a growing feeling that it should be purchased by the Government and extended to Fairbanks as a means of developing that region, and without too close consideration as to immediate profits. That Alaska can ultimately be made to support several railway lines is generally believed.

Postal rates on magazines have been under discussion, and the House of Representatives at Washington has passed the Administration Bill, providing for a change. At this writing the feeling is that the Senate will concur and the new rates put into effect. There has long been an annual deficit from the operations of the Post Office department, though Canada, with equal distance, equivalent rates, and a smaller volume of business, manages to keep a balance on the other side of the ledger. The Postmaster General says that the deficit is due to the low rate allowed on magazines and their great bulk, due to the liberal advertising patronage that characterizes American periodicals. He proposes to raise the rate on all magazines of which individual editions weigh more than 4000 lb. By a strange coincidence this increased burden will fall heavily on the particular publications that have been criticizing the Administration and indulging in the pastime that has come to be known as 'muck - raking.' Others are not affected, though, naturally, such a provision places a fixed limit on the profitable growth of any periodical. The publishers maintain that loss to the Department is due to political rather than business management, to absurd rates for transport by rail, and to favours extended to newspapers, which are carried free, for example, within the county where they are published. As to the railway rates, the Post-Office pays more for transporting mail than is paid by the Express companies, and, in some instances, even more per pound than the cost of first-class passenger rates. At the same

time the whole business is so badly administered and true costs are so hard to determine, that it may be true as contended by the railways, that the Post-Office pays too little rather than too much. It is probable that the new rates will be put into effect and that the resulting storm of criticism will force the Department out of politics; in which event the benefit will be worth the cost.

Calumet & Hecla, and the proposed consolidation, continues to be discussed. As is generally known, the Calumet & Hecla has been not only well managed but extremely

and has long been interested in an important group of subsidiary companies. Recently it was proposed to consolidate these with the parent company, and thereby give an indefinite lease of life to a corporation that has become in a sense an American institution. Immediately numerous difficulties were encountered and the final outcome is uncertain. The Michigan legislature, which is dominated by the farmers of the southern part of the State, proposes a tax of $\frac{1}{2}$ cent per pound on copper as mined. This would make a difference of \$357,500, equivalent to \$3.50 per share, to



MAP OF NORTHWESTERN AMERICA, SHOWING ALASKA AND THE YUKON.

profitable. The parent mine is nearing exhaustion, and if the company is to be maintained new properties must be purchased or developed. The American practice has not been to preserve the individual companies after the mines that gave them name were worked out. It is more usual to distribute all earnings and allow each stockholder to make his own reinvestment. The matter came up before the board of the Goldfield Consolidated and, after full discussion, it was decided to adhere to current custom. Extra dividends have therefore been paid by this company, only a working surplus being carried. The Tonopah Mining Co., on the contrary, is understood to be husbanding its surplus with a view to expansion if opportunity serves. Calumet & Hecla has adopted the plan of re-investment,

the Calumet & Hecla, on the basis of the business of 1910. When it is considered that of the 71,500,000 lb. produced by the company, 40,000,000 lb. coming from subsidiaries yielded no profit in 1910, it may well be understood that plans for expansion are at a standstill. Another difficulty is one raised by T. L. Chadbourne, for many years general counsel for the company, and owner of 3100 shares of Ahmeek stock. He has had a bill introduced into the Legislature providing that in case of a corporation merger dissatisfied minority shareholders may obtain a court appraisal of their holdings, and be paid the same in cash. This bill is likely to pass, and as the result would be that the Calumet & Hecla would have to purchase for cash holdings worth many millions, the matter is serious.

SAN FRANCISCO.

Cyanidation.—Improvements in ore treatment continue to come to light and nowhere do they attract more attention than in the Western States of America. The Clancy process, recently announced, has naturally elicited much discussion. This process involves two stages: (1) the manufacture and constant regeneration in the pulp of a halogen cyanide compound, such as iodide of cyanogen, by use of the electric current; (2) the regeneration of active cyanide compounds from the resulting sulpho-cyanides and potassium cyanate. The process has not yet been tried on the Coast, but has been used in the Portland mill at Cripple Creek, Colorado, and is being adopted in the Ajax mill. If it prove as successful as is anticipated by Mr. J. C. Clancy, it will mean much for the districts producing low-grade sulpho-telluride ores. Mr. A. W. Warwick has discussed the principles involved in the process and from independent experiments has found it possible to make an extraction of 95% on \$13 ore. Publication of additional results will be awaited with much interest. In the meantime metallurgists in California and Nevada are working toward lower expense with standard processes. The new cyanide mill at the Empire mine at Grass Valley is modelled closely on the lines of demonstrated success as its neighbour, the North Star. The tailing from the stamp-mill is received by the Merrill classification equipment, where it is divided into sand and slime. The slime overflow from settlers and sizers flows to clarifiers, four in number, 24 ft. in diameter by 22 ft. deep, filled with false conical bottoms sloping 45° toward centre, and annular inside launders for clear-water overflow. This overflow is conveyed to a water-wash tank. The thickened slime, sp. gr. 1.4 to 1.8, is drawn from centre to the bottom of the clarifiers to 4 agitator vats 10 ft. diam. by 18 ft. deep, fitted with central cylinder having nozzles below for compressed air at 10-lb. pressure, conical false-bottoms sloping 50° toward centre of vat and piped throughout for continuous system of slime treatment. After agitation the slime flows to the filter department, where it is treated by two Oliver continuous filters of 70-ton capacity. Among the new features of the plant is the vacuum-pump used in connection with the Oliver filters, which at 90 r.p.m. makes a 24-in. vacuum and elevates the filter effluent 41 ft. to a 16 by 20-ft. storage vat. This pump is doing excellent work and was designed by E. L. Oliver. The underflow of classified sand

from the sizing-cones is treated by leaching. Zinc-dust precipitation in Merrill presses is used. At the Pittsburg Silver Peak mill at Blair, Nevada, arrangements are being made to increase the capacity by introducing tube-mills and enlarging the slime-treatment department. At the Tonopah Extension concentration of the slime has been discontinued and the tube-mill product now goes direct to the settling-vats for cyanide treatment. Contrary to expectation neither cyanide consumption has increased nor has the extraction fallen. At the Goldfield Consolidated within the last year numerous changes have been made. Chilean mills and Deister tables have been added and the crushing capacity thereby raised to 850 tons per day. The benefit of these increases in capacity has not been reflected in a lower cost because the larger amount of base ore now being treated has caused cyanide consumption to rise. One interesting innovation is the introduction of bromo-cyanide in treatment of the concentrate. The practice is modelled after that of Western Australia. The bromo-cyanide is applied in giving a third and final wash to the concentrate while in the agitation-vats. It has proved entirely satisfactory. The new refinery at this mill is now in use. It is unusually well built and complete and makes it no longer necessary to ship impure bullion.

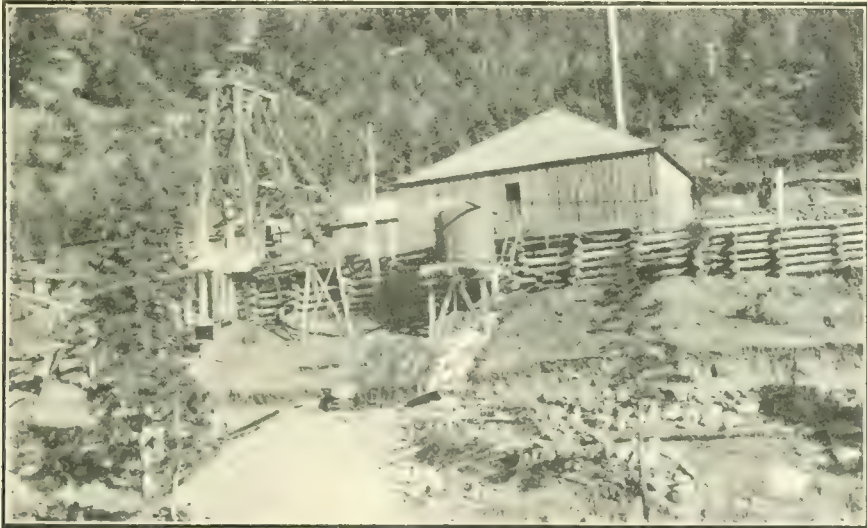
Comstock Mines.—The story of the Comstock is well known and it is sufficient to recall here that for many years the leading mines have been in the hands of trustees who, in most cases, were not heavy stockholders, and who have managed them with more of an eye on the stock market than the stopes. In the last two years there have been serious attempts toward reform, and especially toward increasing the actual amount of mining on the Lode.

In the West the great Comstock vein is still pre-eminently 'The Lode.' The Sutro adit has been re-opened and persistent pumping has allowed part of the old 2500-ft. levels to be recovered. The new work in the Mexican and Ophir ground has been in charge of Whitman Symmes, who is now able to report the actual cutting of an orebody of old-time richness and character. The ore is a breccia of quartz cemented by metallic sulphides, and contains \$40 to \$65 per ton. The body is 10 ft. wide. How long it may prove to be is as yet uncertain, but it is at least significant that wholly new orebodies should be found. The discovery was made in ground lying to the east of the main lode, where for 700 ft. overhead the ground is unbroken. It will be

recalled by those familiar with the history of the Comstock that this is ground of which Von Richtofen thought well, and his predictions as to the Comstock have proved notably accurate. The general feeling has long obtained that so rich a lode probably still contains much ore that could be made to pay by modern methods, but all recent attempts to place the mines on a good basis have failed because of the difficulty of securing control.

Power is an important factor in mining, especially in those Western States where fuel is not abundant. An unusually large number of mines are supplied by hydro-electric power which is transmitted, in places, a couple of

themselves are not being unduly burdened. The service is generally good. Demurrage on account of line troubles amounts to but $1\frac{3}{4}\%$ in two districts recently examined. One mining company is seriously considering the adoption of internal-combustion oil-engines, which are now used successfully at pumping-stations along the Gulf Coast pipe-lines, and elsewhere in the East. Another suggestion, and one likely to be put into effect, is the building of central power-stations in the oil-fields and the transmission of power rather than oil. Many mining and manufacturing districts can be reached cheaper from the oil-fields than from the water-power districts.



INTERMEDIATE SHAFT OF ROOSEVELT ADIT AT CRIPPLE CREEK

hundred miles. Under such conditions power is necessarily expensive, and peak-loads must be watched closely. The Goldfield Consolidated company has put in a storage-battery plant to equalize the load; this is expected to pay for itself in a few years. Such a plant is beyond the means of the smaller companies whose managers must do the best they can to distribute work equally through the day. While rates are necessarily high, it is probable that even the most economical mine-plants would cost more. The power companies are paying dividends and making additions, but, in certain cases, at least, are allowing nothing for depreciation. For companies whose main business is that of supplying mines, where the ultimate extinction of the business is certain, this is an especially serious omission. It indicates, however, that the mines

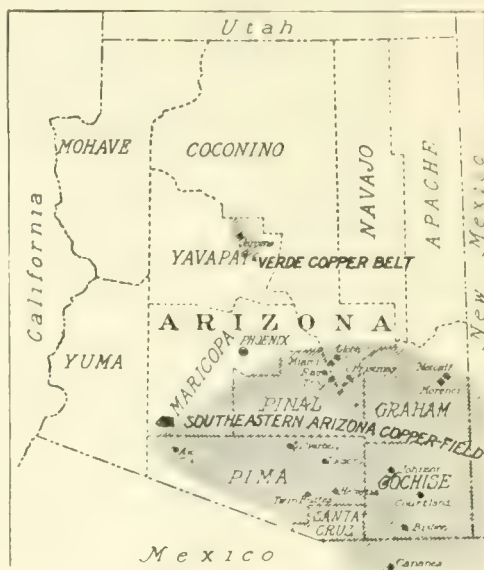
Porphyry coppers, using that term in the broad sense of disseminated copper deposits suited to operations on a large scale, attract as much attention in San Francisco as anywhere. The Nevada Consolidated, which by the way has just closed a notably successful year, was developed by San Francisco engineers. It is now announced that W. H. Aldridge is to assume management of the Gunn, Thompson & Co. interests, and will make his headquarters at Los Angeles. Mr. Aldridge has been successively metallurgist for the old Colorado Smelting Co. at Pueblo, manager for the United Smelting & Refining Co. at Helena and Great Falls, Montana, and of recent years managing director for the Consolidated M. & S. Co., representing Canadian Pacific interests in British Columbia. In his new position he will have direction of widely scattered proper-

res, including the Mason Valley (Nevada) and Inspiration (Arizona) mines. The Inspiration Copper Co. will shortly install an electric system. A 110-kw. generator has been purchased and will be placed in the new power-house near the Joe Bush adit. This generator will be of sufficient capacity to supply current for the lighting system and for the 75-ton experimental mill. The Colorado shaft of this company has been sunk to a depth of 635 ft., and to reach a depth to correspond with that of the station on the 500-ft. level of the Bush shaft it will be necessary to sink 25 ft. deeper. At present the Inspiration company is employing four churn-drills, one of which is used in drilling on the eastern end of the property; two are used in drilling about 1000 ft. north of the Joe Bush shaft, and the other at the south end, where the drill is in ore. Recent estimates credit the property with 20,000,000 tons in reserve, and it is expected to become an important producer. At Wabuska, in Nevada, the railway is complete, and a smelting plant is now being built to handle the Mason Valley ores.

Copper Supplies.—Statisticians have been busy recently figuring the probable life of the copper mines of the United States. While such estimates necessarily possess no great accuracy they are interesting, and it may be remembered that a year ago J. Parke Channing called sharp attention to the fact that ultimately the same shortage in copper ore must be expected as is now being felt in regard to timber. The life of the Calumet & Hecla is officially stated to be about 15 years. The mines of Butte are harder to appraise, but it is believed by many that in the next 20 years most of them will be exhausted. The big porphyry mines that will be main factors in production during the next 10 years may be figured about as follows: Utah copper, present tonnage, 150,000,000; Nevada Consolidated, 40,000,000; Ray Consolidated, 80,000,000; Chino, 30,000,000; Inspiration, 20,000,000; Miami, 15,000,000; a total of 335,000,000 tons. Allowing an additional hundred million tons to cover further developments and the entry into the producing ranks of such properties as Giroux, Mason Valley, and others, a total of about 435,000,000 to 450,000,000 tons of ore may be fairly estimated. In two years from the present time it is safe to say that the various properties in the porphyry group will be handling a total of 60,000 tons per day, which is equivalent to nearly 22,000,000 tons per annum. Simple division, therefore, fixes the life of the known important members

of the porphyry group at approximately 20 years. The United States is now exporting 600,000,000 lb. of copper annually.

Miami.—This, the well-known Lewisohn property in Arizona that has been developed under the direction of J. Parke Channing, will soon begin production. Although it was the intention to start the concentrator at the beginning of the year, and to that end men were employed at night, so many delays have occurred that it is probable it will not begin before March. The non-arrival of pipe for the water-line from the pumping-station to the mill has been one of the principal causes of delay. The new tramway from the concentrator on the hill to the railroad in the Miami



The copper region of Arizona.

townsite is approaching completion, and should be ready in the next two weeks. Preparations are being made to build a dam across the canyon below the concentrator. This dam will form an impounding pond for the tailing from the mill. A force of men is building a wagon-road for the company from the power-house to the principal works; this road will replace the one that will be put out of service on account of the construction of the dam. The company, as announced some time since, will ship concentrate to Cananea for smelting.

Oil Legislation.—Relief for men in the oil region is now in sight. The House of Representatives at Washington has passed the Bill prepared by the committee sent from California, and the Senate is expected to consent to the measure before adjournment. The

Bill provides that, if the record be otherwise faultless, a patent to oil land shall not be refused because of transfer or assignment of interest on the part of the locator prior to discovery. This will allow the patenting of 'association' claims taken up under old laws and customs prior to the recent withdrawals and the extension of the principle of the Yard decision. It also applies to future discoveries on land not withdrawn, but as the Department is active in reserving all possible oil or gas land, that feature of the matter is of minor importance.

VANCOUVER.

Sheep Creek.—The steady production of gold by the stamp-mills on Sheep creek, in the Nelson district, and the satisfactory results of development work on other properties on which bonds have recently been taken, have attracted British capital to the scene, and C. F. Law, who recently visited London, has bonded, on behalf of a British South African gold mining company, the name of which is not yet announced, the Queen mine. This is the oldest producer on Sheep creek, having a record of nine years, in the course of which it has sent out gold bricks to the value of \$770,000. The ore is found in veins from 2 to 20 ft. wide, in quartz filling fissures traversing a band of quartzite. The gold is associated with ores of silver, zinc, molybdenite, and tungsten. On the Queen there is a 20-stamp mill, with four Wilfley tables; 60% of the gold has been saved on the plates, and the concentrate has been shipped to the smelter. The ore averages about \$10 per ton. The mine was for some years owned and operated by William Waldie, of Nelson, who sold it to a Wisconsin syndicate, which, after running it for about two years, bonded it to Mr. Law, on his return from London, for \$500,000. The two other properties equipped with stamp-mills and producing gold are the Nugget and the Kootenay Belle. The Nugget has a 4-stamp mill and two Frue vanners, and during the three years the mill has been running has produced gold to the value of about \$241,000, the ore running \$14 per ton. Development has disclosed three parallel veins of an average width of from four to five feet, occurring in the same band of quartzite as that traversing the Queen ground. The Kootenay Belle is equipped with a 10-stamp battery and two double-stamp batteries, also a Wilfley table and Frue vanner. Its production over five years amounted to \$100,015, the ore milled running \$15 per ton. For the past year the mine

has been non-productive pending the development of the property under a bond. Some definite action may be expected on the part of the new owners. The Mother Lode, which shipped to the smelter ore to the value of \$46,683, when under preliminary development by the prospectors who originally held it, was bonded two years ago by J. McMartin, of Cobalt, who is now figuring on a plant adapted to treating the ore, which is more complex than on neighbouring properties, though apparently higher grade. The shipments so far made, from picked ore, gave returns of \$70 per ton. Several other properties are under development, and from the results so far achieved it is reasonable to expect that the camp will make notable progress.

A Nelson Consolidation.—As a result of recent successes at Sheep Creek, some activity is being shown on Toad Mountain in the vicinity of Nelson. A Vancouver syndicate, in which it is understood British capital also participates, has taken over the property of the old Hall Mining & Smelting Co., of London, an old enterprise in which British capital was enlisted. With this have been acquired the interests of the Kootenay Development Syndicate, the Bank of Montreal, the Dandy & Ollie Consolidated Mines, the Starlight Mines, and several private holders, in a large area of adjacent properties on which orebodies have been proved up, but which are of a value below that which has hitherto admitted of economic operation. This syndicate is now at work investigating processes, and among other steps has sent M. Davys to London with consignments of ore for treatment by the Murex process.

New Companies.—A decided improvement in the methods of organizing mining companies is evident here. For instance, in the case of the Kootenay Gold Mines, the capitalization is kept down to \$250,000, in shares of \$1 each, and the stock is offered and being placed at par. The board of directors consists mainly of the practical men who have for a number of years successfully operated, with their limited means, the property that the Company is acquiring, namely, the Granite-Poorman, and these men will remain in charge of it. The ore has milled from \$6 to \$8 per ton, and the investigation of the accountants shows profits equivalent to 10% on the capital now being subscribed. By means of more extended development, and improvements to the plant, it should be possible to obtain even better results.

MEXICO.

Lead and Antimony Exports. Cookson & Co. of Newcastle-on-Tyne, purchasers for several years of the lead product of the Torreon custom smelter, are negotiating for the lead bullion of the Towne smelter at San Luis Potosi, and may enter into a contract. The Towne product now goes to the United States. The Torreon smelter has notified the Cooksons that, beginning with March, there will be a considerable increase in lead bullion, due to the contract recently entered into with the Compañía Minera de Naica, operating important lead-silver mines in Chihuahua. As a result of this contract the Naica concern abandoned plans for a smelter to cost 1,000,000 pesos, and will supply several hundred tons of ore daily to the Torreon plant. The Cooksons own the principal antimony mines of Mexico, situated in the States of San Luis Potosi and Queretaro, and operate an antimony smelter at Wadley, a station on the National Railways in San Luis Potosi. The smelter output amounts to hundreds of tons monthly, and the antimony produced and the lead purchased are shipped to the Cookson refinery in England on Hamburg-American steamers, from the port of Tampico. The antimony mines were purchased several years ago from A. Weill and M. Elsasser, of Mexico City, the former owners receiving £80,000 each, in cash and securities. With the exception of mines at Santa Maria de Miera, in Queretaro, all the antimony properties are provided with facilities for transport. The Santa Maria de Miera ore is hauled about 100 kilometres to Bernal, a station on the National Railways. The mules now employed will be replaced soon by motor-cars recently purchased in England. The Cooksons are also interested in oil lands in the State of Veracruz. Clive Cookson, one of the principals, is expected in Mexico soon on business connected with the interests of the concern.

Zacatecas-Durango Railroad.—Contracts have been let by the National Railways of Mexico for a line to be built from Cañitas, on the Mexican Central, in Zacatecas, to the Durango capital, 296 kilometres. This line will open the Sombrerete, Chalchihuites, Nieves, and Nombre de Dios mining districts, and will result in greatly increased activity in those districts of Zacatecas and Durango. The railroad has been projected for several years, and a few years ago the necessary concessions were secured and a company formed by Robert S. Towne and his associates, who have extensive holdings in the Zacatecas districts men-

tioned. The financial depression in the United States interfered with the scheme, and later the concessions were taken over by the National Railways. Subsidies aggregating 1,280,000 pesos have been granted by the Zacatecas and Durango governments, and the Towne interests have agreed to a cash contribution. Construction has started at the Durango end, and work will be soon under way out of Cañitas.

Guanajuato.—Twenty of the 40 stamps of the new mill at the Tajo de Dolores mine, the property of the Providencia Mining & Milling Co., are dropping, and the remainder will soon be in commission. It is estimated that the proved ore in the mine is sufficient to keep the mill in operation for the next five years. The Tula Mining Co. has started its 20-stamp concentrating and cyaniding plant. The Oro Grande Mines Co. has increased the capacity of the Guanajuato Amalgamated plant, taken over last year, to 500 tons daily, by the addition of re-grinding equipment. Supplies for the mill are being obtained principally from the Refugio and Bolañitos mines and dumps. The company is earning a profit, and is devoting it to the unwatering and development of the mines. Work on the Nueva Luz cross-cut of the Mineral Development Co. has been suspended temporarily, due to the fact that the Proprietary Mines Co. of America, which is financing both the Mineral Development and Providencia companies, has been devoting its energies to the completion of the new Providencia plant. As a result, the cutting of the Mother Lode of the district in depth will be delayed until autumn. Owing to a scarcity of profitable ore, only 40 of the 80 stamps of the Guanajuato Consolidated Mining & Milling Co. are now dropping.

Oil Development.—S. L. Doheny, of Los Angeles, head of the Mexican Petroleum and Huasteca Petroleum companies, has announced that \$2,500,000 will be spent in building a pipe-line from the Juan Casiano field in the State of Veracruz to Mexico City. A concession for such a pipe-line was secured a few years ago, and much right-of-way has been arranged. It appears certain that the line will be built at least as far as some convenient railroad point on the high central tableland. Oil from the Juan Casiano field is now carried in tank-cars into Mexico City for the plant of the Mexican National Gas Co., another Doheny enterprise. By reason of the success of the Huasteca company in the Juan Casiano field, and the big gusher of the Pearson interests in the Portrero del Llano district, prices of oil-lands and oil-leases in Veracruz have advanced con-



A BIT OF OLD MEXICO.

siderably of late. The present year will see much exploration in the Veracruz region, and much English and American capital will be concerned in the work. The Pearson gusher is reported to be practically under control, and much oil is being saved. California men interested in the Veracruz districts are planning the organization, at some later date, of a Producers Agency, patterned after the organizations that have been successful in California. These plans include control of much of the fuel-oil produced in Veracruz, and the creation of a market for the product in Mexico. An abundant supply of fuel-oil will solve Mexico's fuel problem.

MELBOURNE.

Zinc.—While the war party in Germany preaches the story of the crooked diplomacy of the British Government, their countrymen in Australia are enabled, owing to the freedom of competition permitted under the Union Jack, to achieve important trade conquests. One position after another has been acquired. This has been done so quietly, yet so persistently, as to evoke a sense of admiration at the skill with which an extensive trade has been brought under control, to the great advantage of German commerce. The prize first sought and won was the lead output of the mines of Broken Hill. Last has been the zinc output of that field—representing one-sixth of the world's output of that metal—and the expanding output of copper in the Commonwealth. German capital has even come to help in the financing of the recently established copper refinery at Port Kembla, N.S.W. Therefore, in the manifold business of exploiting the industrial metals in the Commonwealth, the hand that controls the ultimate output of the mines is that of the German, not of the Briton. His only real competitor is the Broken Hill Proprietary Company, with its lead smelting works at Port Pirie. Even that company has found it advantageous to join forces with the Lead Convention, in which German interests predominate. So far as the zinc output goes Continental buyers have, until quite recently, had no real opposition. The Broken Hill Proprietary is establishing zinc works. When it is seen that £100,000 has been required to erect a plant capable of treating only 28,000 tons of zinc concentrate per annum, as against the output of the Barrier of 420,000 tons per annum, the company cannot be regarded as a possibly serious competitor to the Continental zinc-buyer. There is nothing secret about the metallurgy of zinc. What frightens those who would otherwise enter the list of zinc smel-

ters is the first cost of the works. Then comes the need for suitable clay, cheap coal, and highly-trained labour, such as is at the call of the German and the Belgian spelter-makers. Last of all is the trade connection that Germany especially has so sedulously cultivated of late years.

Lack of Enterprise.—No satisfactory explanation can be furnished why the British manufacturer or capitalist failed to enter these fields of competition other than that of lack of enterprise. He early knew of the resources of the Broken Hill district. He invested heavily in its mines. As time went on he was furnished with indisputable evidence of their permanence. Yet he failed to stretch out his hand to secure any real control of the industry. This is the more remarkable, as at one time Great Britain was prominent in smelting. The Broken Hill trade was worthy of capture. In December last silver-lead concentrate of the value of £125,000, and zinc concentrate worth £88,000, were sent from the Barrier. Adding other minerals, the total value of the export for that month alone from Broken Hill was £225,000. To such figures add the yield of Australian copper handled by the German buyer, then the extent of this special trade can be grasped. No one can complain of such a conquest, except Australians, who may regret that the smelting of all the lead and zinc cannot be done here. The British smelter has his own indifference to thank for the fact that the export of metal-bearing products goes past his ports to the Continent. Germany and Belgium may have natural advantages, but with ample capital, a previous experience of the industry, and with cheap fuel available in Great Britain the uninterrupted drift of this trade is astonishing. The reason that suggests itself why the transfer of the smelting industry to the Continent has taken place is that British capitalists have felt that they could employ their money better by abandoning the business to Continental firms. Australia, in viewing the course of this trade, can have no self-reproaches. The field was open to all. That Continental dealers have realized its potentialities has at least meant to the Australian that the zinc industry instead of languishing for want of a market, has now become a substantial source of profit to the Barrier mining companies.

German Protection.—Setting aside this question of material gain, it is instructive to contrast the attitude adopted by the German authorities to conserve to its people the full benefits of the great potash deposits of the

country. American capitalists obtained an interest in the output of some of the German properties. Thereupon the State was induced to pass legislation that practically deprived these citizens of the United States of any benefits accruing under the contracts they had made. Diplomatic representations from Washington failed to remedy the grievance, the German government declaring that it must be regarded as paramount in matters of domestic concern. When the decision in this dispute is connected with the bellicose utterances of the leaders of the Pan-German party, can there be any question as to the policy that makes for peace and good-will among the nations? Is not freedom of competition such as has been permitted the Continental adventurers who, under the British flag, have secured such a hold on the metal trade of Australia better rather than the aggressive action adopted toward American investors in the German potash mines? The way the control of the zinc output has been exercised is to enable a Zinc Convention to be formed. This now regulates the world's price of zinc, thus giving to the German, Belgian, and French members, the benefit of the ramifications of a huge trade combination. A very slight awakening of British national sentiment on the lines of the potash episode might seriously affect those interests. That is a view of the situation that may be presented to those who are apt to overlook that sentiment is a force in business as well as in national affairs.

Broken Hill is quiet. The men have gained their increase in wages, with the exception of the engine-drivers and the fire-men, every company has fluttered into the folds of the high-wage agreement, even the Proprietary coming into line both at the Barrier and at its Port Pirie works. The men certainly are top dogs just now, especially as the Proprietary is preparing to resume work underground after two years of idleness. Moreover, a splendid fall of rain has set everyone in good heart by assuring a six months' supply of water. The value of the exports of the Barrier for 1909 and 1910 may be given as follows:

	1909	1910
Silver-lead concentrate.....	£1,247,959	£1,400,621
Zinc-lead concentrate.....	763,229	952,249
Silver-lead crude ore.....	42,344	53,969
Silver-lead slime.....	23,052	26,096
Gold and copper.....	5,722	362
Total.....	£2,082,306	£2,433,297

The advance in the price of zinc has made all the difference to the Barrier, and now that the

Proprietary and the British mines are to go ahead the total for the year just ended should be largely exceeded by the output for the current twelve months.

Bullfinch leaves a nasty taste in the mouth no matter which way it is turned. The parent mine could jog along with commendable ease were it not that there is a hitch with the men over wages. So the board is engaged in the enjoyable occupation of sitting tight. The trouble may not be long-lived, still it is irritating at the present juncture when the world wants to know that there is one decent claim on the field. Some amusing, though sorrowful incidents have occurred. The Golden But-



Eastern Australia.

terfly, which was to have had 12 acres, has been cut down to about $5\frac{1}{2}$ acres, owing to overpegging or wrong pegging; the promoting syndicate has handed over another block somewhere else to make up the shortage in area. Great talk has been made about this noble action, but nothing is said as to the placing of a claim on the market before the area it held was defined. Perhaps, like a score of other flotations, the company bought an application for a lease and then had to be satisfied with what land it could get allotted. The Great Finch has found nothing and intends to look elsewhere for a nesting place; the Great Chaf-

finch also is still prospecting for a nest egg and cannot find one. The Bull Oak has gone into liquidation, the only satisfaction about that transaction being that the brokers had no time to unload before the crash came. The Marvel Loch mine has shown its poverty; it paid one dividend, then ran into poor ore, the manager resigned, another went hence, stopped one day on the claim, and handed in his resignation rather than remain to build things up. So what with the claims at one end of the Yilgarn district panning out thus, and with nothing at Bullfinch to cheer the soul, the fools that rushed in to buy scrip on mad flotations are wondering how they are to get their capital back. A market, of course, remains; but it is a mere simulacrum. There is Stock Exchange padding but beyond that nothing to justify the expenditure that is going on.

Sulphide Corporation.—The reports of the Sulphide Corporation and the Minerals Separation Co. have been received with intense interest on this side of the world. These two companies have been doing pioneer work for the flotation processes. Whatever may be the result of the litigation in which they are involved, their work deserves the greatest commendation. It is no secret that when Mr. Courtney, general manager for the Sulphide Corporation, made up his mind to work first on the magnetic process and next on the flotation process, he was content to jog along quietly, leaving others to do the splashing. The Minerals Separation Co. in the same way has never hoisted the flag to show that the structure of their process was complete. They have experimented gradually eliminating error until now the word has gone round that the Zinc Corporation has got Mr. Faull back to run the Minerals Separation plant against the Elmore to try which is the better. This matter was mentioned at the meeting of the Minerals Separation Co., but it can now be stated that the two processes are being compared side by side. W. L. Baillieu goes to London presumably to the Coronation, really it is believed to try and bring about a consolidation of the various flotation interests. It is said on this side that he expects a knighthood. Personally, I think he would have ten-fold more gratification in pulling off the flotation amalgamation.

The gold yield for Australia and New Zealand for 1910 can now be stated accurately. The production for the year shows a further falling off: in 1910 the output was 3,182,677 oz. fine, against 3,434,591 oz. in 1909. The value of the production is ap-

proximately £13,500,000, compared with £14,591,000, so that there is a decrease of over £1,000,000 in the value of the output. On a three years' basis the decrease is £2,600,000, a somewhat startling decline when the state of the industry is considered. As against this, however, there is an important improvement in the production of the base metals. The increasing output of zinc and copper compensates largely for the reduction in the gold yield. The totals for the last three years can be set out as follows:

	1908 Oz.	1909 Oz.	1910 Oz.
New South Wales	24,799	33,700	189,114
Victoria	676,907	646,907	528,800
Queensland	161,399	150,907	140,884
Western Australia	1,648,505	1,595,263	1,470,627
South Australia	9,162	7,420	12,000
Tasmania	60,712	44,670	45,000
Commonwealth	3,080,535	2,949,671	2,736,485
New Zealand	471,290	181,660	146,192
Total	3,552,325	3,434,591	3,182,677

If a period of ten years be taken, the output of Australia will be seen to have varied as follows during that term:

	Oz.	Value
1901	3,297,228	£14,005,733
1902	3,487,030	14,811,948
1903	3,836,095	16,294,684
1904	3,774,999	15,847,557
1905	3,660,995	15,550,100
1906	3,444,607	14,631,745
1907	3,184,193	13,511,460
1908	3,680,535	12,750,000
1909	2,949,671	12,600,000
1910	3,182,677	11,600,000

The Chillagoe Company is taking steps to float the Etheridge Gold Mines. This is not a large affair, being £60,000 in 120,000 shares of 10s. each, the Chillagoe Company taking 20,000 shares and £10,000 in cash, the balance of £40,000 (less underwriting expenses of about £5000) going to the credit of the Company. The mines that have been acquired are the Big Reef, Havelock, Nil Desperandum, and Queenslander. These mines were for some time the mainstay of the Charleston and Etheridge districts. The Havelock was operated for some time by an English company, but costs of transport and difficulties of treatment caused the claim to fall again into the hands of the original owners, who then sold it to the Chillagoe Company. All these mines have been worked to some depth. The idea now is to put up a modern mill, and develop the claims under the most scientific conditions. A. C. McGeorge, the well known West Australian, is in control, and he will have a thoroughly efficient staff at his disposal. A few days ago gold was struck at 700 ft. in the Durham Consols mine near-by. The ore carried 2½ oz. gold and a large proportion of silver. The importance of the strike is that pay-ore has been got at the depth stated.

DISCUSSION

Our readers are invited to criticise anything appearing in this magazine and to discuss other subjects of general technical interest.

Prospecting in the North.

The Editor:

Sir—I have read with interest H. V. Winchell's article on 'Prospecting in the North,' in which he shows chemically that, on account of the mineral having been removed by glaciation, prospecting north of the Canadian-American international boundary line, is from the outset a rather forlorn hope, but lest Canadians might feel too badly about it he hastens to assure us that we have not lost much, as it was never there. There is no doubt about the light shed upon geological problems by chemistry, but one light illuminates only one side. Physics may illuminate another. Some geologists are of opinion that fractures are produced by physical forces, hence might be found in the glaciated zone, in fact some who have worked in it fancy they have detected them. It would be difficult to find an area of equal size with as many quartz-filled fractures as are to be found in Porcupine, in the heart of the glaciated region. In British Columbia in some localities dyke-filled fractures are so numerous that it is difficult to find any wall-rock. McConnell, who spent the summer in the Portland Canal district for the Geological Survey, complains, not that there were too few places for mineral deposition, but that they were distressingly numerous. The main fissure on which the Portland Canal mine is situated he states to be a very strong one, traceable certainly for two, and probably for four, miles. In fact there seems to be no dearth of avenues and receptacles for mineralizers in the North. The Vancouver series at points along the west coast of British Columbia near the contact with the Coast Range batholith is, as Mr. Winchell observes, deficient in veins, but not because the region is boreal, but because the series at the time of mineralization was, in the district referred to, deeply buried and under great pressure; hence it was physically, as well as chemically, impossible for veins to be developed. Further west the series was at this time not so deeply buried and it is mineralized. On the inland side of the batholith where the Portland Canal district is situated, the rocks were similarly near the surface and are also mineralized.

While, as he suggests, one may think of a hydrosphere varying from zero at the pole to a maximum of a thousand feet at the equator, in the light of certain facts, such as the known

water-circulation below the deeply frozen ground in the North, the minimum evaporation, the steady precipitation, conditions favouring seepage in the North, as against conditions favouring evaporation and surface run-off in the equatorial regions, one might possibly think of the reverse: a hydrosphere relatively deep in the North. In the Centre Star mine, at Rossland, in the glaciated zone, descending water was encountered 1300 ft. vertically below the surface. Mr. Winchell seems to assume that glacial conditions have always existed in the glaciated area. This, of course, was not the case, if palæontological evidence is worth anything. Since the ores have been deposited in pre-Glacial time, many in pre-Middle Cretaceous time, and over much of the country probably in pre-Cambrian time, it is the pre-glacial conditions that have an important bearing. In boreal districts, in Alaska and the Yukon, where the country has not suffered glaciation, weathering is deep and intrusive. He suggests that in the zone of glaciation the character and value of the ore as revealed at the surface may be taken as representative of what is to be expected below. It saves worry and expense if surface values can be depended upon to maintain in depth. It offsets some of the disadvantages of having low-grade ore. The main production is from low-grade bodies anyway. Unfortunately this recipe cannot be depended upon. Veins in the glaciated region in places do show secondary concentration. But if it be admitted that secondary enrichment is absent, after all it is only one of the factors entering into the formation of workable deposits which may be formed on a commercial scale without it. If secondary enrichment is absent veins like those of Cobalt do not need it very badly.

Mr. Winchell's article is readable, suggestive, and were it not for some awkward facts, convincing. But where mining has been prosecuted in the glaciated zone, the ore deposits as a rule have been mined to as great a depth as is usual in the South. The greatest iron, the greatest copper, the greatest nickel, and one of the greatest silver districts of the world are all in the glaciated zone, and it is difficult to point to a spot of equal area in the golden South that can match this record. These results achieved in the prospected fringe of the glaciated belt make one wonder if the large proportion of our rich mines being found south of the former glacial mantle is due not so much to chemical principles as to the area of the glaciated belt being still unprospected.

It is related of the scientists of the Royal

Society that upon being questioned by King Charles as to why, when a fish was introduced into a dish full of water the water did not overflow, they showed their Royal master that in accordance with the inexorable laws of nature it could not, whereupon he demonstrated to them, experimentally, that it did. Before committing ourselves to an explanation of the absence of workable deposits in the North it may be as well to demonstrate the fact. At present their absence is not only unproved, but such evidence as is available is against any such supposition.

R. W. BROCK.

Ottawa, January 27.

The Rhodesian Boom.

The Editor:

Sir—To be candid: neither disagreement with your views nor ambition to improve on

bourse in Paris. Obviously there is abundant proof of mineral resources in the Chartered company's domain waiting for the pick of the prospector. The existence of scores of 'exploration' companies, trusts, financial corporations, agencies, and syndicates speaks volumes for the confidence placed in the future of the sunny land to the north of the Limpopo river. However, their proportion to the number of producing and profitably worked mines looks rather incongruous for a country extolled in late years as the happy hunting ground of the 'small' man and mining party. The anomaly is indeed perplexing and confirms the view that considerably larger profits are expected from the flotation of new mines than from the steady exploitation of going concerns. In this respect, too, as you say: "It is the same old game."

Most people dabbling in South African min-

Name	Number of Shards	Tons	Value per ton	ORE RESERVE				MARKET VALUE		Profit Assured per Share	Percent- age on Market Value	Remarks
				Total Gross Value	Loss in Reserve	Available Value	Working costs including development	Net Working Profit	Price of Share	Total Value		
Eldorado Banket..	150,000	13,000	27	73,700	4,000	69,700	40,000	29,700	40s.	300,000	10	90
Gaika	196,000	18		740,000	40,000	700,000	250,000	450,000	67s. 6d.	1,012,500	44	56
Giant	40,000	10		84,000	8,000	76,000	50,000	26,000	35s.	424,600	2s. 2d.	94
Griffith	355,500	9		672,500	71,100	601,400	266,400	335,000	80s.	1,038,960	10s. 6d.	68
Highway	800,000	174,788	32	1,184,000	52,000	1,132,000	262,000	870,000	51s.	2,040,000	21s. 9d.	42
Lowland	350,000	40,000	10 3	85,000	8,000	77,000	60,000	17,000	10s. 6d.	183,750	1s.	84
Lowland	71,000	16,000	26	252,000	14,500	237,500	57,000	180,500	60s.	81,000	13s. 4d.	22
New Lowland	176,000	4,000	10	61,000	8,500	85,500	55,000	30,500	22s.	193,600	3s. 6d.	16
South West	27,000	12		69,000	5,000	64,000	34,000	30,000	17s. 6d.	385,000	1s. 3d.	92
Star of Africa	500,000	965,000	4 8	973,000	61,000	912,000	386,000	526,000	87s. 6d.	2,187,500	21s.	24
Thistle	11,721								25s.	342,000		
Thistle Etina.....	65,000	60,000	6 5	82,000	12,000	70,000	60,000	10,000	26s.	84,500	3s.	11½

your pregnant style of writing is prompting me now to add to the comments appearing in your February number. Moreover, my conscience does not worry me for having missed an opportunity in Rhodesians. But, hailing as I do from the other side of the Channel, I feel a little disconcerted about the efforts being made to dump a lot of Rhodesian paper on the

ing shares are imbued with the erroneous impression or idea that they are interested in banket propositions, and banket mines admittedly lend themselves to investment on somewhat industrial lines. But the great variety of gold deposits existing in Rhodesia cannot be capitalized and appraised reasonably except on the basis of solid ore reserves brought

within the reach of the surveyor's tape and the miner's pick. To accept exceptional occurrences in size and grade of orebodies as natural and permanent would be folly. Uniformity (in banket mines) assures stability; deformity (in quartz bodies) threatens equilibrium. And naturally in looking at the abnormal body even of a Giant with a disproportionate head and arms we gasp in wonderment lest he may stand on weak legs when we cannot see them. So it may be assumed with regard to extraordinarily rich values in gold ore deposits that "*les extremes se touchent*." Sudden enrichment, as we see in the Globe & Phoenix, may be balanced to a certain extent by gradual impoverishment. If we, therefore, apply the proper test of valuation to some of the prominent mines in the Rhodesian share-list, the appended table offers little gratification to the careful investor. The knowledge, moreover, that the profit in sight may be based on the scanty assurance of a fallible expert will rather augment the discomfort caused by a recognition of the risk to which his capital is exposed. The smaller the estimated percentage of profit in sight the more reckless he will consider the gamble. Apparently the Rhodesian mining share-list provides an unusually great number of gambling counters. And what I wanted to point out in the interest of all parties on both sides of the Channel is that such material is hardly fit to cement the happy *entente cordiale*.

THEODORE RUBISCHUM.

London, March 3.

Tin Dressing in Bolivia.

The Editor:

Sir—The mines of Bolivia, principally silver, tin, and copper, have been so rich that they have yielded handsome profits with the primitive ore-dressing appliances of the country. Though there are a few companies working on modern lines, yet the majority of owners object to new machinery, especially concentrating tables. I desire to point out on what ground these men make their statements, and why in so many instances they have thrown out modern appliances after a more or less unsatisfactory trial.

The fact is that if modern machinery is to be used the mill site must be carefully chosen, with due forethought as to water supply, fall, etc.; good mechanics must be employed to look after it, and a plentiful supply of spare parts must be kept in stock, involving expenses which the general run of mine owners in Bolivia are not willing to incur. This is

especially so as regards wages, where a native who receives 5 bolivianos per day is comparatively better paid than white men brought out under a contract. In some instances the origin of the trouble experienced with tables of different makes can be traced to the want of development of the mines, and consequent shortage of ore for milling, the frequent feasts, some of which last three to five days at a time, and the occasions when, owing to either drought or to severe frosts, the supply of water is insufficient for running the mill. During the time that the mill is idle it is important in this country to keep the water running over the tables, for if this is not done and they are made of wood, except in the case of heavy vanner timbers for instance, they will, within a short time, warp so as to become quite useless. It may be argued that this is the case in other countries, but personally I know of no other country where wood, which is alternately wet and dry, will warp so quickly as in the high altitudes of Bolivia and Peru. In the case of one company which has started work on modern lines, the mill took over a year to arrive at the mine after leaving the United States. When I saw it about ten months after it left New York the tables were in a very bad state, as were also the jigs, which were made of comparatively heavy wood; but this was hardly to be wondered at as they had been exposed to the rays of the tropical sun for some five months without covering of any kind.

Even if the tables arrive at the mine in good order, they are put up by a native blacksmith or mechanic who probably knows little of concentrating machinery except that of the simplest kind. When ready for use the tables are handed over to an engine man, or to a man taken from the buddles, and in the course of learning the adjustments he will probably render them useless for good work. I have seen some of these men get good results from tables if they care to take the trouble, but the majority regard them as useless and give them no fair trial. It is harder work to look after one or more tables where speed and water supply are not constant, than to drowse away the day feeding a round buddle, and the natural result is that the table is soon unfit for use. In such cases the tables are thrown away after a short trial, and all tables condemned as useless.

Costs are usually kept in the form of so many Bolivianos per quintal (100 lbs.) of concentrates produced, and unless the content of the ore is known, which is seldom the case, it

is difficult to compare the costs at the different mines. As there is no attempt made to maintain the ore sent to the mills at a constant grade this naturally varies much in each mine at different times, but speaking generally the ore contains from 7 to 10% tin.

One argument in favour of the simplest machinery is the time required to get spare parts for the new machines, for these, even if ordered by cable, will take from three to four months to reach the mines.

Within the last few years some good mills have been put up, and two of these are doing really excellent work. The first is of German design and construction, a mechanic having been sent out from the works to take charge of the erection. The ore as milled averages 8% tin, and occurs in a rather soft matrix. The crushing is done with rolls, the coarsest products being about 10 mms. in diameter. The sizing is by trommels, from which all but the finest products go to the jigs, the concentrates of these jigs giving 66% to 68% tin. The middling is recrushed, and with the fine, treated on tables. Nearly 90% of the tin recovered comes from the first jig treatment. It is claimed, and I believe on very good grounds, that the loss is only from 8% to 10% of the total tin contents of the ore. It may be difficult for those familiar with the usual losses incurred in tin dressing to believe these figures, but bearing in mind the nature of the ore, the carefully graded crushing, and the attention which is paid to the treatment of the small amount of slime produced, I am sure that they are not far wrong.

The other modern plant is for the treatment of a silver-tin ore, in which the minerals occur in a comparatively fine state of division in pyrite. The silver is first extracted by lixiviation, and the residue treated for its tin content. In this case the tin oxide occurs in a far finer state than in the former instance, and instead of rolls the crushing is done by ball-mills through a 20-mesh screen. The sand goes to three-compartment jigs, and the slime to the slime tables. From each compartment of the jigs finished concentrates are obtained; the tailing goes to Huntington mills to be re-crushed through a 60-mesh screen. Below the Huntingtons a careful system of classification is in use, and the classified products are sent to various tables. Owing to the high iron content of the ore the concentrate does not average more than 62% to 64% tin, and the loss is stated to be 9% of the original tin content.

As this is not a paper dealing with modern

tin concentration I do not describe these two mills in detail, but only mention them to show that a modern mill when properly designed, and under good technical management, will be as successful in this country as anywhere else.

Summing up, the reasons advanced against the use of modern machinery are:—

1. The bad condition in which it often arrives on the mines;
2. The bad way in which it is sometimes put up;
3. The incompetence of the man often in charge of it, and, in the case of tables, his ignorance of the principles of concentration;
4. The bad state into which tables quickly fall if left dry, even for short periods;
5. The difficulty of obtaining spare parts.

The only two of these reasons which need be taken seriously are the first and the fourth, as the others can be avoided by good management and forethought.

The first is a serious difficulty, though not as much so as it was about four years ago, as the ports of disembarkation are not as congested as formerly, and the railway and custom-service is better; this being so machinery is not subjected to the rough usage and exposure that it formerly received.

In some parts the question of the water supply is most serious, as this varies greatly, not only from season to season, but from year to year, according to the snow that falls on the higher mountains, and whether the glaciers give off sufficient water to supply the springs and streams of the lower country. In one year I have known the permanent snow line to be 2000 ft. lower from May to September than it was during the preceding and succeeding years.

If a company is prepared to put in charge of their work a good technical man, with good assistants, sufficient power, and a good water supply, then by all means put in the best machinery available, always bearing in mind that the more simple it is the better in an out of the way place, where the native labour is not as a rule intelligent. On the other hand, if the mine has recently been acquired from a former owner, and there is not sufficient money to put in a really good plant, it is best to stick to the old methods. But it is folly to attempt to take a middle course by putting in a few pieces of modern machinery to be worked by unskilled men, for this will be only a waste of money.

A. BASIL REECE.

Avicaya, Bolivia, February 3.

A PIPE-BRIDGE

THE illustrations show an aqueduct recently constructed by the Société Electrométallurgique Française near Briançon, Hautes Alpes, France. This type of bridge was first designed by Paul Heroult, and several have been in use for many years. For the development of water-power to be used in the smelting of aluminium from the bauxite mines in the south of France, it was found necessary to divert the river Gironde and bring this across a gorge through which the Durance passes, just above the confluence of these two

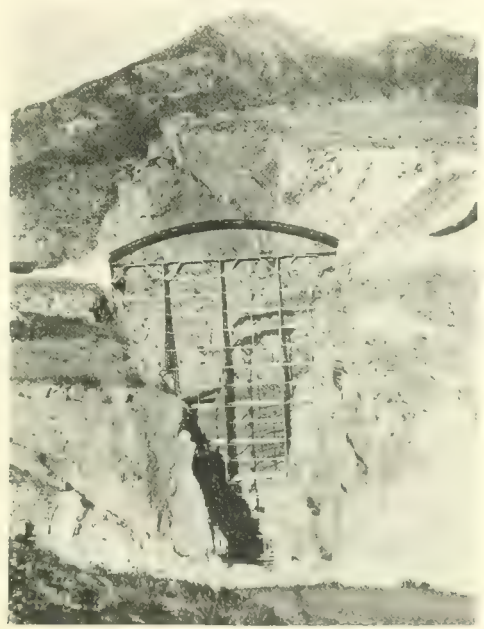
of 230 ft. The pipe is 8 ft. 8 in. internal diameter and constructed of rivetted steel plates varying from $\frac{5}{8}$ to $\frac{3}{4}$ in. thick. The water in the pipe (at the bridge, which is the bottom of an inverted syphon) is under a head of 164 ft. The total length of tunnels in the diversion is about 10 miles and the power available at the works 40,000 hp. This is the newest and largest works erected by this Company entirely for the development of various electric-smelting purposes.

The cost of the timber-work was 25,000



Aqueduct in construction.

streams. Another tunnel diverts the Durance, and the water of the Gironde joins that of the Durance after dipping down 165 ft. in the form of a U-tube or inverted syphon, at the bottom of which it crosses the gorge 300 ft. above the river-level in this aqueduct, which is unique as regards the depth of the gorge and the span. The pipe is arched to form a bridge without any stays, or other means of strengthening it, and is entirely self-supporting. The pipe rests at either side on concrete and masonry foundations, 60 ft. long, with flanges attached so as to give a firmer hold. The span is 203 ft. 6 in. and the depth of the gorge 302 ft. The bridge is built on the arc of a circle having a radius



Aqueduct completed.

francs, and the whole operation of erecting the scaffolding and building the pipe was accomplished without any injury to life or limb. The wooden structure will all be removed shortly, but it had to be strongly built as the wind in the gorge is often almost cyclonic. The steel plates were rolled into pipes at the adjacent works into sections about five feet in length and rivetted together in place. On the top of the scaffolding a platform was built and rails put down. On this, a structure with hoisting arrangements was arranged so that it could travel across the bridge and raise the sections of the pipe to the necessary level. A rail is placed on each side of the pipe, to facilitate crossing.

PERSONAL

J. M. BELL has resigned as director of the New Zealand Geological Survey and sailed for New Caledonia on March 12, intending to reach London in June.

GEORGE J. H. BLAKEMORE, formerly manager of the Great Cobar, is in the United States.

E. H. BRANDT is in Algeria.

WALTER BROADBRIDGE has resigned as consulting engineer to the Prestea company.

R. GILMAN BROWN, now a director of the Kyshtim Corporation, has also been appointed consulting engineer to that company.

J. W. BRYANT is in charge of the Cornell mine, for the Tyee Copper Company.

F. T. BYRDE has gone to West Africa.

WILLIAM CULLEN, manager of the Nobel explosives factory at Modderfontein, Transvaal, is on a visit to England.

WALTER CURRIE is returning to Rhodesia, after a tour in the United States.

W. R. FELDTMANN is making a periodical visit of inspection to Ashanti.

J. H. FENNELL, recently in Spain, is leaving for New York.

J. R. FINLAY has resigned as manager of the Goldfield Consolidated Mines Company.

ANDRE P. GRIFFITHS has returned from Brazil.

W. WYNDHAM GORE has been appointed assistant manager for the Sefevi mine, in West Africa.

E. M. HAMILTON is at the Dolores mine, in Chihuahua.

F. W. HARBORD is in Sweden.

H. C. HOOVER is at New York.

FRANK KLEPETKO is at the Ferrobamba mine, in Peru.

H. H. KNOX has become advisory engineer to the Kyshtim Corporation.

BEN. B. LAWRENCE has returned to New York from Cuba.

THOS. H. LEGGETT was recently in Durango, Mexico.

D. A. LOUIS is in Spain.

V. F. STANLEY LOW has returned to Broken Hill after a tour through Europe and America.

T. M. LOWRY, Inspector of Mines for the Gold Coast, is here on leave.

T. BURNS MCGILL has been appointed metallurgist to the Bwana M'Kubwa Copper Mining Co.

C. ALGERNON MORTLING has returned from the Porcupine goldfield, in Northern Ontario.

HORACE G. NICHOLS is in Iceland.

A. C. PERKINS, of F. W. Payne & Co., is in the Federated Malay States.

WALTER G. PERKINS has returned from Kyshtim and has an office at 62 London Wall.

T. A. RICKARD lectured on February 16 at the University of Birmingham on 'Mine Sampling.'

L. D. RICKETTS is in Egypt.

A. P. ROGERS has gone from New York to Brazil.

WILLIAM RUSSELL has gone to Johannesburg in the interest of J. V. N. Dorr.

H. R. SLEEMAN, manager of the Whim Well Copper Mines, has left London to return to Western Australia.

HOWARD D. SMITH was in Nevada during February.

L. C. STUCKEY, manager of the Copiapo Mining Co., in Chile, will be in London for three months.

ARTHUR E. TAYLOR has returned from a visit to the Indian and Egyptian gold mines managed by John Taylor and Sons.

ARTHUR THOMAS has been appointed manager for the Consolidated Mines of El Oro, Mexico.

G. R. THOMPSON, of Leeds, has been appointed professor of mining in the South African School of Mines and Technology.

W. H. TREWARTHA-JAMES, manager for the Tyee Copper Co., British Columbia, is here on a periodical visit.

S. J. TRUSCOTT has returned from Sumatra.

J. S. WATKINS, metallurgist to the Ashanti Goldfields Corporation, is at home on furlough.

D'ARCY WEATHERBE has resigned as assistant manager to the Orsk Goldfields, but will not leave the mine until June.

H. H. WEBB left for New York on March 1, on his way to Mexico.

HENRY O'K. WEBBER has been elected president of the Transvaal Chamber of Mines, in succession to J. G. Hamilton.

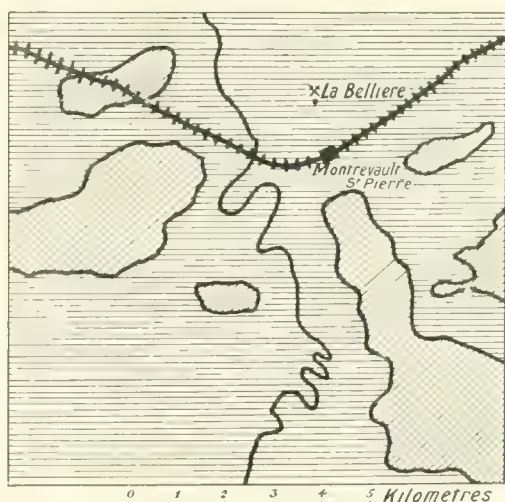
THE GREATEST GOLD MINE OF FRANCE

By THOMAS T. READ.

THAT France possesses any gold mine, great or otherwise, is a source of surprise to many of us, more accustomed to think of France as the producer of a golden vintage rather than of golden ore. Yet there are several gold mines in France, and one of them is not only great but also of historic antiquity. During the period of the Roman occupation of Gaul, some veins of gold-bearing quartz in what is now La Vendée were worked on rather an extensive scale to a depth of nearly 100 ft. When the Romans withdrew work ceased, and the open-cuts became

profit was doubted. But in 1905 the Société des Mines de la Bellière was organized with a capital of 4,000,000 francs, and exploitation went forward so rapidly that a profit of 352,350 francs was shown for 1908, and 981,943 francs in 1909.

The La Bellière mine is situated in La Vendée and is equally distant from the three towns of Nantes, Cholet, and Angers. It is reached by taking the express train to Angers, a local train to La Possonière and the Anjou department railway to Montrevault, which is



Geological Map, La Bellière.

covered with vegetation. In course of time they became the property of a retired Inspector-General of Mines, who lived in his chateau within a stone's throw of the outcrop of the vein, and who doubtless often walked in his park around the borders of the ancient workings without suspecting their true nature. But some fifteen years ago one of his friends who was familiar with old Phœnician tin workings came for a 'week-end,' and, noticing the tree-covered trenches, at once announced that they were the remains of former mining excavations. Although 'float' containing gold and arsenopyrite in quartz was found in abundance, no real prospecting was done. Several years later a small shaft was sunk and penetrated into ore beneath the old workings. Exploration still lagged, as the possibility of treating an arsenical ore at a

about a mile from the mine at St. Pierre-Montlimart. The ore deposit consists of quartz veins in schist and may be considered in two parts. At the western end of the property there are three veins, the first and third being about three metres thick and the second about two. The second vein joins with the first towards the east, and about the middle of the property all three pinch out. Farther to the east are two great lenses of quartz, 15 to 18 m. wide at the widest place, with lengths of 100 and 150 m. respectively. The ore has been exposed by four sets of levels at a depth of 30, 50, 80, and 110 metres. The engineer in charge told me that the lenses were as thick on the 110 m. level as at 50 m. This is satis-

factory, as indicating the size of the orebodies. Approximately three-fourths of the present daily production is obtained from the lenses and one-fourth from the workings on the vein proper.

The ore consists of quartz, containing 15.16 grammes gold per ton (one gramme is equal to 0.643 dwt.), a little silver, partly alloyed with the gold and partly in some unidentified silver mineral, enough arseno-pyrite to make the ore average $\frac{1}{2}\%$ arsenic, and a little chalcopyrite, galena, and pyrite. The general process is to stamp the ore to pass through a 30-mesh screen and then over amalgamating plates, 43 $\frac{1}{2}\%$ of the gold content being arrested at this stage. The pulp is then classified into sand and slime, the sand being concentrated on Wilfley tables, yielding 4 $\frac{1}{2}\%$ of concentrate. All three products are then cyanided, and a further extraction of 47% obtained, making a total of 90 $\frac{1}{2}\%$. The concentrate is roasted in Maletta furnaces for the production of white arsenic. During 1909 68,880 metric tons was milled at a cost, for mining and milling, of 25.10 f. per ton; 953,701 grammes of gold was recovered, or 46.15 f. per ton.

The general features of the orebody are shown in the accompanying plan, and I also give a cross-section taken from M. Laporte's 'Les Mines d'Or en France.' But it should be noted that M. Laporte has given the maximum thickness of the veins and leaves the reader to infer that they extend throughout the property and to an indefinite distance on each side, whereas they actually pinch out about the centre of the property, the ore to the east occurring in the shape of lenses. I cannot certify to the coalescing of the veins in depth, as I was not shown the 110 m. level, and no maps and plans of the workings are kept at the local office. Assuming that the section is correct, it is evident that the third vein will join the first in depth.

The mine is opened up by three two-compartment shafts arranged in a straight line 250 m. apart. The relation of the shafts to the orebody is shown. The mill is near the westernmost shaft. Besides these three shafts there are some minor adits and shafts for admitting material for filling the stopes. Hoisting is done in cages by geared electric hoists.

The method of stoping the lenses is as follows: A drift is driven along each wall and a third through the centre of the lens. Rises are then made at intervals of 15 m. and extended to within a safe distance of the level above; the rises along the walls are carried through and serve to bring down the filling for the stopes. Beginning at a safe distance above

the bottom level, slices two metres wide and two metres high are taken out and the broken ore moved down the chutes. The roof is supported by a little light timbering, as required, and as fast as the slices are made the space is filled. Part of the material used for this purpose is the tailing from the cyanide plant, but as the men object to it, claiming that the cyanide solution contained in the tailing makes the air bad, other surface waste is used as far as possible.

The filling is done on day-wages, but the mining is done by contract at the rate of 5.75 francs per cubic metre, out of which the miners have to pay for the powder used, but have everything else furnished them. They have also to set any timber required for their own safety. Good men make about 5.50 f. per shift. Development work is also done by contract. Most of the underground work is done in two shifts of eight hours, but the tramping and hoisting is done in three 8-hour shifts, as the reserve capacity of the bins at the mill is rather small. In shaft-sinking 6-hour shifts are employed.

The workmen are of two kinds, native French and Greeks. At first workmen from the slate quarries near Angers were imported, but now the local labour is trained to the work underground. Bulgarians, Servians, etc., have been employed, but they were unsatisfactory. The Greeks are more satisfactory than the French because they are not organized and are more easily managed. Those I saw were bigger men than the French and could probably drill better and faster. There is some friction between the two classes and they are kept apart in the workings. The company has lately undertaken to construct small houses to be let to the workmen. I saw these comfortable-looking cottages, which, they said, rented for 20 francs per month.

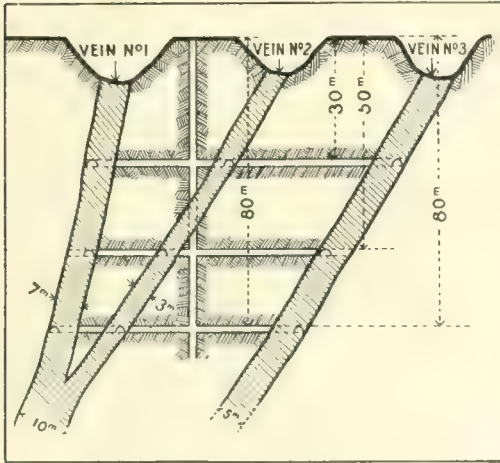
The drilling is all done by hand. An attempt was made to introduce stoping-drills, but the men objected to them and used to stuff bread-crusts into the valve-chambers in the hope of breaking them. I did not see the drill used here, but if they were like those employed at another near-by prospect, the men were not without reasonable excuse. It may be remarked also that the air was used at a low pressure, too low for any drill to do good work.

The ore from all three shafts goes to scales to be weighed and then to a large jaw-crusher. The product, about 3 $\frac{1}{2}$ in. ring, goes to a short belt-conveyor, where two men remove any particles of wood or iron. The belt delivers it to

two smaller crushers and these feed two other belts, which convey it to the top of the stamp-bins. There are 70 stamps, 40 of 1000 lb. and 30 of 1500 lb. each. The 70 stamps crush 280 tons per day, indicating an average duty of 4 tons. The pulp passes over amalgamating plates 8 ft. long, and then over a couple of shaking amalgamating-tables. In this way 43½% of the gold is caught. The pulp then passes to Dorr classifiers and the resulting slime goes to large settling-vats where it is thickened and then cyanided by agitation. The sand goes to 8 Wilfley tables. The resulting concentrate (amounting to about 4½ to 5% of the ore and containing 10% arsenic) is reduced in fine-grinding pans and then agitated with strong cyanide solution for 15 hours. This

quantity had been allowed to accumulate. About 14 tons of concentrate is treated daily, and one ton of arsenic is extracted. There can be but little profit in the arsenic, as it sells for 300 f. per ton, and less than two-thirds of the output found a market last year.

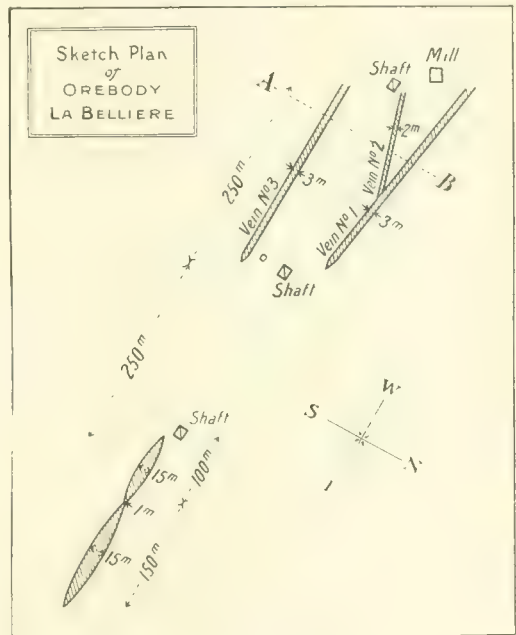
The sand from both sets of Wilfley tables and the middling from the second set are cyanided by percolation in vats. It should be remarked that the mill possesses three tubemills, which are to be employed to grind the sand from the Dorr classifiers, but these are not now in use, as the present slime-plant is taxed to its full capacity. The sand now goes first to de-watering tanks, where it is drained to make it more porous, and then conducted to a screened set of vats where it is leached by



Cross-section on line A-B,
after H. Laporte.

gives a fairly complete extraction of the gold with a cyanide consumption of 2 lb. per ton, which is properly regarded as a notable improvement over the former consumption of 8 lb. per ton.

The concentrate after cyanidation is roasted in two Maletra furnaces, the crude arsenic being caught in dust-chambers and then leached with hot water, to remove the soluble portion and re-distilled. The re-distilled fume is caught in a series of three condensers. The product from the first of these is ready for sale; that from the other two is leached again, and distilled a third time. The residue contains 8 to 10% copper, 5 to 6% lead, and about 10 grammes gold per ton. Formerly, when the gold content was higher, this residue was sold in Wales, but now it is discarded. It would certainly seem as though it would pay to install a small reverberatory furnace to treat this material by smelting, after a sufficient



percolation. The solution contains 0.16 lb. K Cy per ton, and is passed at the rate of 30 tons per day for 15 days. The percolation-vats are of modern type and are provided with Butters distributors and Blaisdell excavators. The tailing is handled in two ways. That from the slime-plant is taken by a skip to the top of a dump to the west of the mill. The sand is handled by a Blaisdell tailing-stacker on the eastern side of the mill. The waste cyanide solution cannot be allowed to escape into the adjacent stream on account of the fish, so it is allowed to stand in a large vat, permitting the air to destroy the cyanide before it is finally pumped to the top of the tailing pile and so allowed to seep gradually into the stream.

The precipitation of the gold is done in the usual way in zinc-boxes, the only unusual feature being the ceremonious manner in which the work is done. There is only one entrance to the room, which is protected by double locks, the floor inside is carpeted, and the workmen wear slippers, while the boxes are neatly covered like gigantic coffins.

About 250 men are employed on the surface, only a few of them being engaged in the mill. These men work for 12 hours and their wages averages 4 f. per day. They are local men who have been trained so as to make satisfactory workmen.

A commendable feature of the entire equipment is that the company has refrained from mechanical experiments, perhaps regarding it as enough of an experiment to begin work in a country where gold mines were (with the exception of La Lucette) previously unknown, without adding anything in the way of untried machinery and processes. Hence the machinery is of standard design, most of it made by Fraser & Chalmers. The electrical power-plant and the system for supplying water are especially worthy of note.

The treatment of the ore does not offer any special problems, as the amount of arsenical concentrate is not small, nor is its gold content especially high, being only about three times that of the average ore. Naturally, there is a good deal of cyanide consumed in treating this material, but recently the manager has reduced the consumption; and now that it is one-fourth what it was in the preceding year he has reason to congratulate himself. The question of disposing of the tailing presents a minor problem, as the space now available for this purpose is not sufficient. This difficulty has been solved, in part, by the increased use of tailing for filling.

At the end of the last financial year the company signalized its development as a successful enterprise by the payment of interest on its shares at the rate of 6% for the five years during which the mine has been in operation. This was in addition to setting aside the legal reserve and providing for amortization at the rate of 25% on the shafts and underground working, and 15% on the surface installation. The amount of ore available in the underground workings is 256,490 tons, a gain of about 25,000 tons over the preceding year. With quartz veins in schist it is usually desirable to keep development work well ahead of stoping, on account of the variable nature of such deposits.

Exploratory work has been done in the

vicinity of this mine, in the hope of finding other similar deposits, but without success. There is little or nothing in the way of surface exposures to serve as a guide, and prospecting on a large scale seems more likely to prove a source of expense than of profit. It is unfortunate that the district does not possess the type of men so useful in other gold-producing regions, who, on their own initiative, perform the preliminary work that leads to systematic exploration.

Fire underground at Butte has been a disturbing element for several years and many parts of the old workings have had to be bulk-headed. Numbers of attempts have been made to extinguish the fire but without success, and managers have adopted the policy of barricading as securely as possible. From time to time the fire breaks out and must be again fought. January 14, there was an outbreak on the 1200-ft. level in the High-Ore mine that is more serious in its possible consequences than any in the history of the district. The High-Ore drains all the Amalgamated mines, and there are numerous connections with all the others. The gas drove out the miners from the North Butte, Mountain View, Modoc, and other mines. Through the courtesy of the Butte-Ballaklava Copper Co. the fire was fought from that property, the only point from which the fire could be reached, since the shaft affords the strong down-draft. The use of this shaft was promptly tendered, and accepted by the Anaconda company, and the air-line converted into a water-line for making hose connections in order that the streams of water might be thrown on the fire. The fire stopped the pumps on the 2800-ft. level of the High-Ore mine and drove out the men from the main central pumping plant of the Amalgamated company on the 2200-ft. level. The water pumps are now working, but on the 2800-ft. level, though no longer flooded, the pumps are still out of commission. Guards were placed at connecting workings and several of the mines can now be worked. The Ballaklava mine is free from fire and smoke, as it was promptly bulk-headed against the fire until the Anaconda engineers were allowed to tear down the fire-doors to get access to the fire area. The lower levels are flooded as a result of the generosity of the Butte-Ballaklava company in turning the air-line over to the Anaconda company, thus stopping the Ballaklava pumps. The fire will doubtless be conquered, though a stubborn fight is in prospect.

THE CHOROLQUE TIN DISTRICT, BOLIVIA

By AN OCCASIONAL CORRESPONDENT.

IN your issues for June and September you published two interesting articles on the production of tin in Bolivia and described the resources of the country as regards this metal. There was one district, however, that the authors did not mention, so I am sending you some information about it. I refer to the Chorolque district, which is situated half-way between Uyuni and Tupiza, toward the south

high and tin ore is found on various sides of it. The veins at present contain clean tin and the ore requires no roasting. In many parts of the district, however, sulphides of all sorts are found as well, some of them containing silver, but their metallurgy is a difficult matter. Work was started on the deposits many years ago, and at the present time the firm of Aramayo, Francke & Co. is operating three



CHOROLQUE DISTRICT SHOWING CIRCUITOUS MULE AND CART TRACKS.

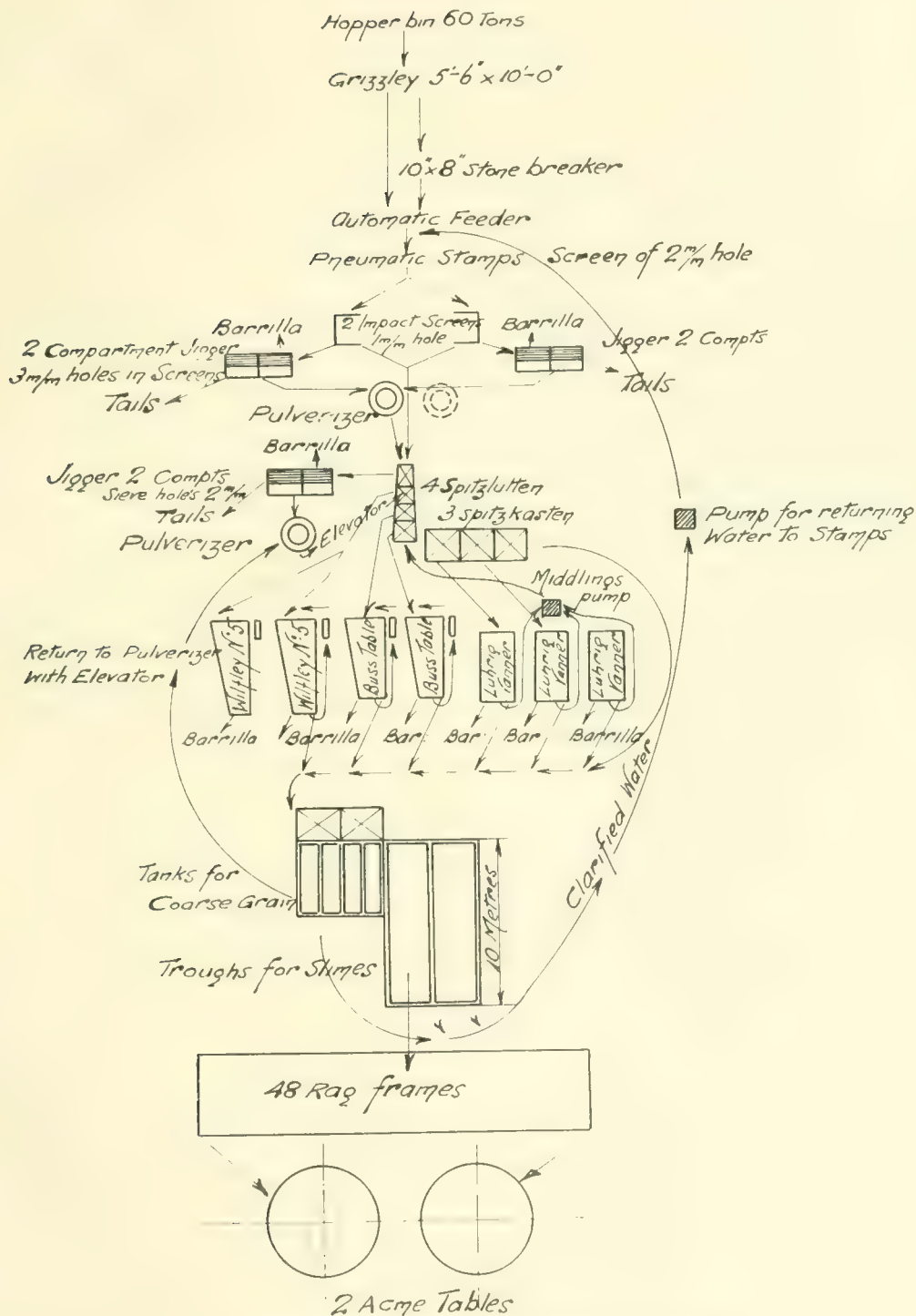
of the country and at some distance from other centres of production. At the present time communication is effected by mules and carts starting from Uyuni station on the Antofagasta & Bolivia Railway. The country is mountainous, rough, and bleak, and the tracks are circuitous but well maintained. It is hoped that the projected railway to connect Uyuni with Tupiza will be completed before long. It is also hoped that connection will be made between Tupiza and the Argentine railway system. Chorolque mountain is about 18,000 ft.

separate mines, the Chorolque, Tasna, and Chocaya. Three years ago they purchased from other owners the mines on the side of the mountain opposite to the Chorolque mine, probably containing the same veins. These mines are of special interest because a modern crushing and concentration plant has just been erected at Sala-Sala for the treatment of the ore therefrom. This plant has been built by Holman Brothers of Camborne, and as it represents the latest practice in tin-dressing, I am sending the flow-sheet. The annual out-

put of the productive mines above mentioned is nearly 100 tons of about 90% concentrate. As the mountain sides are precipitous the mining is done by a series of adits one above the other. Until quite recently the whole of the extracted ore had not been treated, much being left behind in the dump. An idea of the richness of the ore may be gained from the fact that the dump assays 3% metallic tin. The cassiterite is coarse and comparatively little slime is made. The dressing plant so far has consisted chiefly of jigs, and only in a few cases have tables or buddles been employed for treating the finer parts of the ore. There are many reasons why closer work was impracticable, reasons which are well known to engineers who have to combat the disadvantages of the scarcity of transport, labour, and fuel, at an altitude of 13,000 to 15,000 ft. in a bleak, cold, and windy country. The new plant at Sala-Sala has been designed with a view to improving the extraction and of conducting mining and dressing operations in more approved fashion. One of the engineering works to be undertaken was the building of a wire rope-way 3 miles long, with a fall of 3000 ft. This was not easy because in places the mountain side is composed of loose debris and the foundations of the piers were insecure. Special provision had also to be made against the severe wind-storms that occasionally sweep the country. The new mill has been built on the side of the mountain and the ore goes through by gravity. The estimated capacity is 50 tons of ore per day, and the building has been arranged in such a way that it may be easily duplicated. The ore is first screened through a grizzly with 2-inch opening, and the coarse crushed in a breaker. It is then sent to two Holman air-cushion, or so-called 'pneumatic,' stamps which have screens with 2 mm. holes. This type of stamp has been used before in Bolivia at a mine near La Paz and gave good results. So many people think that the word 'pneumatic' denotes its operation by compressed air that I may as well say that the pneumatic part relates solely to an air-cushion cylinder between the stamp-
stem and the connecting rod, which is driven by power from a crank. The air-cushion makes it possible to work the stamp at 170 or 180 blows per minute. The capacity is thereby greatly increased, and, as already mentioned, each stamp will crush 25 tons of hard ore through 2 mm. holes in 24 hours. At first a punched screen was used, but subsequently wire screens were substituted, so as to increase the rate of discharge. It was also found de-

sirable to feed little and often in order to keep the height of the charge in the mortar-box fairly regular. An interesting point in connection with the air-cushion device was that at 14,000 ft. altitude a much larger cylinder and inlet holes had to be used so as to obtain the right amount of cushioning. The discharge from the stamps is sent to impact screens having 1 mm. apertures. The over-size is fed to two jigs, each having two compartments with 3 mm. holes in the screens. In the flow-sheet the concentrate goes by the Bolivian name of *barrilla*. The hutch products are sent to a Holman 'grit-mill' or grinding pan having both horizontal and vertical grinding surfaces. The discharge from this mill mixes with the under-size of the impact screens and is sent to a 4-compartment hydraulic classifier. The coarsest material obtained in the first compartment goes to a 2-compartment fine jig with 2 mm. holes in the screen, the hutch products from which are sent through a second grit-mill back to the hydraulic classifier. From the second compartment the material goes to two Wilfley tables, and that from the third and fourth to two Buss tables. The overflow goes to Luhrig slime-tables, or at least the original design intended that this should be done; but in practice it has been found that so little slime is made that it is not worth while sending the overflow over them, but to send it straight to the automatic rag frames, the recovered products from which are further concentrated on two revolving Acme tables. The overflow from the Wilfleys and Busses also goes to the rag frames. In all cases the overflow goes first to settling-tanks and the coarser particles are returned to No. 2 grit-mill. In practice it is found that three-quarters of the metallic contents of the ore is recovered in the jigs. As the plant only started in October the results as regards recovery of the finer products are not yet available.

Power is supplied by means of suction-gas engines, which use anthracite coal obtained from the Swansea district in Wales. The cost of this fuel is about £10 per ton delivered, but in spite of its price gives far better results than anything else. Steam was abandoned at this group of mines some time ago owing to the impossibility of obtaining fuel, the resources in the way of fungus and other vegetable growths and llama dung being exhausted. It is of interest to note that at this altitude the size of the gas engine has to be just double that required to produce the same power at sea level. The loss of efficiency is 3% for every 1000 ft. of altitude.



FLOW-SHEET OF SALI-SALA TIN-DRESSING PLANT.

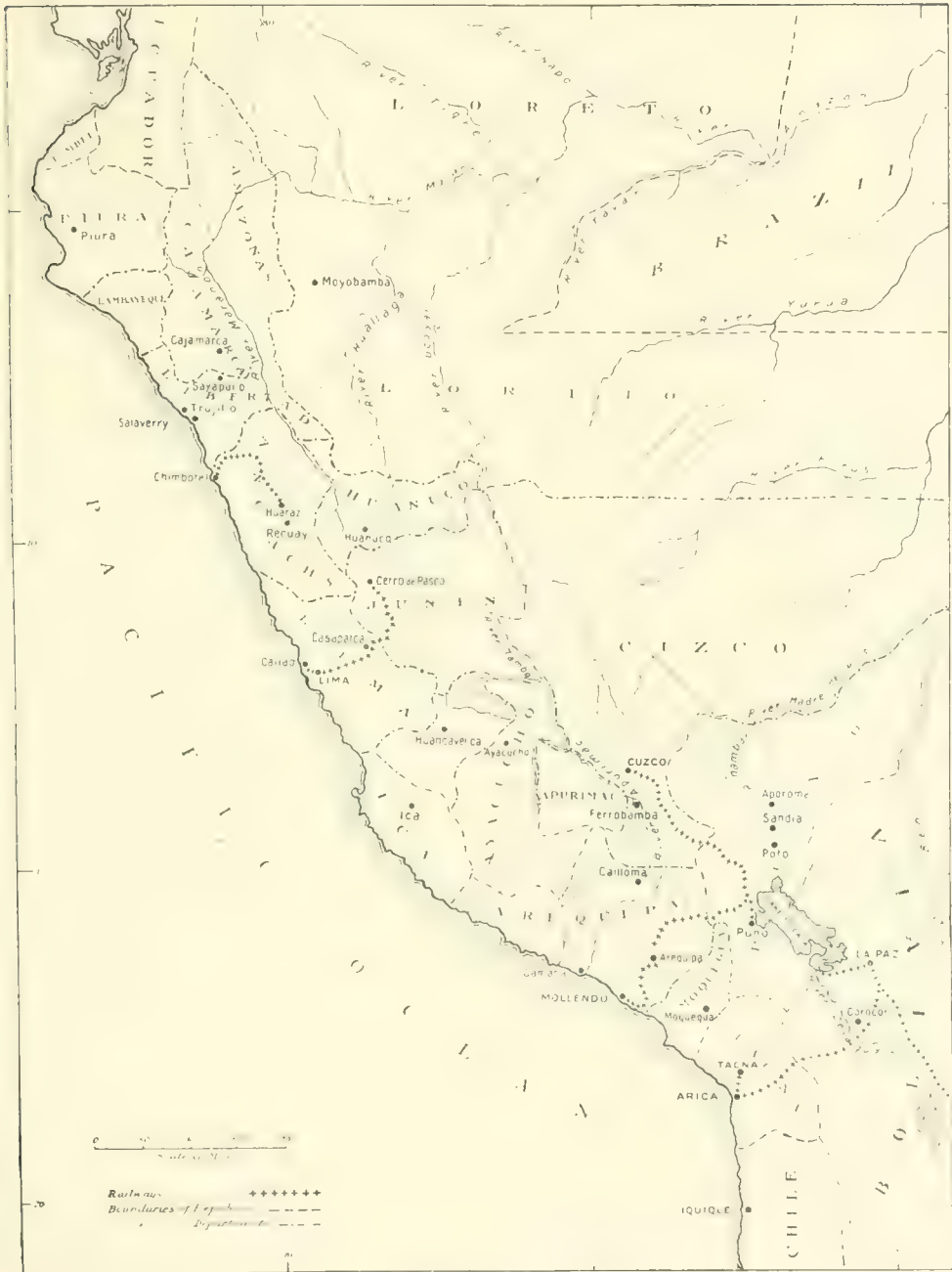
PROGRESS IN PERU

By LESTER W. STRAUSS.

DESPITE the depression that has affected mining in Peru since the break in metal prices late in 1907, the industry has apparently been making headway, more especially copper mining. The most interesting event, as regards the possible increase in the copper output, is the examination of the Ferrobamba property southwest of Cuzco. American capitalists, headed by A. C. Burrage, have recently taken an option, having several months in which to examine prior to deciding on development work. The success of this enterprise, which is stated to control a large deposit of contact-metamorphic ore averaging 6% copper, with some gold and silver, means much for Peru. Water, for power and concentration, is stated to be abundant. Coal, for smelting, is lacking in the immediate neighbourhood but prospecting may result in the discovery of a possible source. Other copper properties are stated to have been 'denounced' in the same region, in which American capital is also interested. The natural outcome of these investigations is an effort to obtain more direct railroad communication with the coast. Several preliminary surveys have already been made and more work in this direction is planned. French capital has been attracted to the copper district of Huailay, about 35 miles southwest of Cerro de Pasco, where for several months an examination of the district has been in progress. The mineral occurs in well defined veins but no large amount of work has been done. The shipping ore has averaged 23% copper with a little gold and silver. A 30-ton furnace was erected some time ago on one of the properties, but its operation has been intermittent. A railroad connection, either with the Cerro de Pasco railway (a shorter line) or with the Central Railroad of Peru, at Casapalca (a shorter haul to the coast, but longer line for construction), has been considered. It is stated that the same capitalists will investigate the Conchucos region about 70 miles northeast from the port of Chimbote. A large orebody, also of contact-metamorphic ore, averaging 3 to 6% copper is said to exist. Some semi-pyritic smelting has been attempted. In the same region silver-copper veins are stated to occur.

Of the productive districts Cerro de Pasco is by far the most important, the Cerro de

Pasco Mining Co.'s operations alone having contributed nearly 75% of the country's output, in producing 42,830,000 pounds of copper in 1910. This includes custom ores bought locally. The mines are to be equipped with electric haulage, which is probably the most radical change in the operations. At the coal mines two disasters, one in February and the other in August, resulted in a total loss of about 90 lives—all Indians—and were due to carelessness displayed in tamping holes with fine coal in place of clay; the mines are dusty. At the smelter several changes were effected, notably in the converting practice, the basic-lined converter having given satisfactory results. The present year will show further improvements in additional blast-furnaces, converters of modern type, and more electric installation to replace steam-driven plant. The improvements already installed, and those contemplated, will probably result in a monthly production of from 6,000,000 to 7,000,000 pounds of copper. Although the past year's monthly average is 3,500,000 lb., the actual smelting time would show over 4,000,000 lb. In December the high production mark of 5,175,000 lb. was reached; the highest individual day was over 200,000 lb. The next important producer is the Backus & Johnson smelter at Casapalca, which shipped over 5,000,000 lb. copper, in matte, or double the output of 1909. Several improvements have been effected resulting in the smelting of an increased tonnage. A system of pot-sintering has been installed, replacing the Brown roasting-furnace. The Carmen adit, after five years of driving, cut the Carmen vein and incidentally a large stream of water that delayed operations for a considerable time. Pay-ore was found. The smelter of E. E. Fernandini, near Cerro de Pasco, has been increased so as to handle 150 tons of silver-copper ores, the copper being used merely as a carrier for the silver. Almost 1,000,000 lb. of copper was produced, and shipped as matte that carried from 1200 to 1500 oz. silver per ton. An experimental plant has been erected to cyanide the tailing resulting from the concentration of the silver ore; promising results are said to have been obtained. Incidentally it might be stated that this is the only cyanide plant in operation in Peru. Experiments have also



been conducted for leaching the tailing resulting from the concentration of bismuth ore. At Tamboraque the smelter of L. A. Proaño has been running intermittently, treating about 50 tons of copper ore daily. Matte averaging between 40 and 50% copper is made, and the year's output being about 1,100,000 lb. of copper. The three smelters above mentioned are responsible for 12.4% of the total year's output. The ores shipped to the United States and Europe, which carry from 12 to 42% copper, with a little gold and silver, contribute 12.8% of the country's copper output. The Morococha district near Casapalca is the largest producer of shipping ores, the Morococha Mining Co.'s output representing 45% of the total ores shipped from the country.

The copper figures, as given, have been obtained from the estimates made by Aron Hirsch & Sohn, who are in the position to obtain reliable statistics. The year's output is given as nearly 26,000 metric tons, distributed as follows, in short tons (2000 lb.):

Blister Copper (Cerro de Pasco)	21,415
Matte.....	3,550
Ore.....	3,645

Total tonnage..... 28,610

The increase over 1909 is nearly 7000 metric tons (or 7700 short tons). It must be noted that a small amount of matte, from the old reverberatories at Cerro de Pasco and from the Maravilla smelter, in southern Peru, is included in the above estimate.

Gold mining has received some attention, especially dredging. The dredge of the Inambari Gold Concessions was not floated last July and preparations are now under way for an early launching. This is the second boat built by the company, the first having sunk, before being completed, in transferring it from bouldery ground to a more suitable place. This is the first attempt at dredging in Peru, and its success will stimulate the industry. The territory controlled by the Aporoma Gold-fields is to be worked as soon as the 45-mile trail, leading to the locality and now under construction, is completed. The importation of machinery will be the next step. It is expected that by the close of 1911 operations will have begun. The Sandia region is known for its hydraulic possibilities but no operations on the scale intended, 150,000 cubic yards per month, have been tried. Vein mining has been relatively unimportant, the only large operations being the New Chuquitambo Gold mines, near Cerro de Pasco, where 40 stamps are dropping, crushing about 100 tons daily.

Only the free gold is recovered which amounts to 50% of the content or about 8 shillings per ton; recent development work at the mine, through a crosscut tunnel, has been encouraging. At the Santo Domingo, in southern Peru, which has been the premier gold mine in the country, no work was done, although plans were contemplated to treat the tailing, accumulated from past operations, and to do some development work. The Montebello mine in the same region has been undergoing development; a little rich ore is stated to have been found. The directors are considering plans for erecting a small mill. The Sociedad Auraria de Cotabambas, operating in the Cochasyhuas district, to the south of Cuzco, has been shipping high grade gold-silver ore and treating the lower grade by amalgamation. A new mill, consisting of stamps and cyanide plant, is to be brought in from Mollendo. The Andaray Co. is erecting Lane-Chilean mills.

Silver mining has not been expanding. No figures are available as to output. At the Caylloma mines the position seems to be improving, as the shares have doubled in value in the past twelve months. The ore mine is principally argentiferous galena; the rich ore is shipped and the lower grade is concentrated. Some years ago cyaniding experiments were made with a view of replacing concentration but the results obtained did not warrant the change. The mines of the Santa Mez Co. continue to make small shipments of rich ore, and pan-amalgamation is used on the lower grades. Silver-lead ores from the Yauli district, are shipped abroad, but in smaller amount than in previous years.

The lead industry has made no advance. The development of some prospects, near Cerro de Pasco, has justified the early erection of a small concentrating plant. There is only one lead smelter in operation and that over 135 miles by trail, in the department of Ancash at Vesubio.

Vanadiferous material seems to be keenly sought for, although as yet no discoveries have been made yielding mineral equal to that being worked at Minasragra, 33 miles northwest from Cerro de Pasco, where from 200 to 400 tons of calcined ore is shipped per month. At Llacsacocha, near Yauli, operations were undertaken with a view of obtaining working results in burning the coal, or asphaltite. The development of the seams depends upon what quotations are received for the vanadiferous ash. A new district, near Casapalca, has been investigated; and a little work has been done.

FINE GRINDING

By H. S. DENNY.

IT may be said without fear of argument that the developments in the metallurgy of clean gold and silver ores in the past decade have been synchronous with the extended adoption of the principles of fine grinding, and today this factor in the treatment of such ores is receiving closer attention than ever before. The many problems involved may be divided into two parts, the first dealing with the mechanical devices for the performance of the work, and the second with the particular application of the method to any given ore.

In the minds of many engineers a prejudice exists against what is known as the 'all-sliming' scheme because of a belief that enormous cost both in outlay for the necessary machinery and in operating it must ensue, the latter to such a degree that any improvement in extraction to be obtained by fine grinding would be more than off-set by the contingent disadvantages. To a limited extent and in special cases this is undoubtedly true but as a generalization it is certainly wrong. 'All-sliming' in its general acceptance is intended to mean the absolute reduction of the whole of the ore to something over 150-200³² fine, but it is also being applied where portions of the pulp are classified and subjected to varying degrees of fine grinding. It appears to me that the term is still applicable to such cases provided that the coarsest product handled is not less than 100 mesh. The use of the term, however, is of no particular moment so long as it conveys something reasonably understandable and the final dictum on that point may well be left to some of the technical societies.

Having conceded the undoubted virtues of fine grinding the questions of greatest importance are its limiting factors and its efficiency in the treatment of a given ore. The limiting factors are primarily involved in a comparison between the added cost of each extra unit of fine grinding and the added extraction, but this is by no means easy to determine accurately. The recent contributions by H. Stadler on 'Grading Analyses and their Application' go a long way toward elucidating the more abstruse of the problems involved in the computation of

the actual work done in re-grinding operations, and if it be allowed that the actual work done can be measured against an accurate record of the power consumed in doing that work, it becomes possible to arrive at the all-important figure of cost.

As to the relative recoveries on various products measured according to the varying degrees of fineness, the difficulties are less pronounced and provided that due care is observed in carrying out the investigation there is no doubt that the point is susceptible of ready determination. It is after making the assumption that these questions can be settled on a practical basis—and this is by no means mere assumption, although finality has not yet been approached—that the really economic considerations arise, and it is with these that I now propose to deal.

Take, for example, a silicious ore containing 5% of pyritic material. Let us assume that this material be crushed to 60 mesh and that from the resultant pulp 90% of the pyritic content can be concentrated out, carrying 70% of the gold. Taking the assay of the ore at 8 dwt. per ton, we then have after concentration:

4.5 tons of concentrate carrying 560 dwt. = 124 dwt. per ton.

95.5 tons of pulp carrying 240 dwt = 2.51 dwt. per ton.

The pulp would then be classified into 65.5 tons of sand containing say 3 dwt. per ton and 30 tons of slime at 1.45 dwt. Again assume that each of these products by agitation and filter-pressing and without any further re-grinding would yield 80% recovery. The question would then naturally arise as to the application of finer grinding and in what particular form. At the outset it is quite clear that the pyritic constituent of the ore would demand special attention. An 80% extraction on the 124 dwt. would leave a residue of 24.8 dwt., and, although from the whole pulp without concentration on the basis of 80% of 8 dwt. the final residue would only amount to 1.6 dwt., it would at once seem possible materially to reduce even that residue by a proper handling of the concentrated portion.

Fine grinding would at once be suggested as the remedy and this might be achieved by:

(a) Re-grinding the whole of the pulp from

³²That is, able to pass through a screen having from 1 to 200 apertures per linear inch.

the crushing plant that is coarser than 60 mesh.

(b) Re-grinding a hydraulically classified portion of the pulp.

(c) Re-grinding a carefully concentrated portion of the pulp.

Assuming that if the products were re-ground to pass 200 mesh, which postulates the grinding of a great portion of it to something much finer, we should increase the extraction from 80 to 94%. The position would then be as follows:

Concentrate.

80% of 114 dwt. = 91.2 dwt.

94% " " = 116.5 " "

An increase of 17.3 dwt.

Sand.

80% of 3 dwt. = 2.4 dwt.

94% " " = 2.82 " "

An increase of .42 dwt.

Slime.

As the slime is already of the required fineness we may assume that the extraction from this product remains at 80% of $1.45 = 1.16$ dwt., although at 94% the extraction would only amount to 1.36 dwt., being an increase of 0.2 dwt. per ton.

It is obvious that it is to the concentrate that we must look for the chief improvement in adopting fine grinding and the question is whether the right policy in this particular case would not be to aim at a very clean concentration with the subsequent fine grinding of that product only. This is an important question and the solution of it must have far reaching effects on the ultimate construction and operation of the plant. The points that arise are:

1. What is the cost per ton of re-grinding from 60 mesh to 200 mesh?

2. Assuming that the sand is not re-ground would it not be necessary to provide a special plant for final treatment. In other words, could the whole pulp be treated as one product—including the re-ground concentrate—if the sand were not re-ground?

3. Would it be necessary to re-grind the sand to as fine a mesh as the concentrate either for the purpose of getting extraction or of making the product suitable for filter-pressing?

4. Which is likely to be the more economical in capital outlay and operating cost, three separate plants, one for concentrate, one for sand, and one for slime, or one plant to take the whole product in one operation?

5. Assuming that 50% of the valuable contents could in the first place be extracted by

amalgamation, although the ultimate recovery would not thereby be increased, would it be advisable to adopt amalgamation?

6. As the concentrate contains the bulk of the precious metals would it not be advisable to make special provision for re-grinding this product, in order to ensure an absolute reduction to impalpability. Could this be done, and how?

Taking these points in sequence: 1. The cost of re-grinding from 60 mesh to 200 mesh will vary according to the nature of the material to be re-ground, and also according to the cost of power and the particular machinery used for the purpose. In my experience the average figure may be put at 3s. per ton.

2. It would be necessary to have a separate plant for the handling of the sand if it were not re-ground, whether the subsequent treatment of the slime involve decantation or filter-pressing. In filter-pressing the presence of coarse sand causes channelling and vitiates the results.

3. It would not be necessary to re-grind the sand as fine as the concentrate either for purposes of extraction or with the object of producing a product suitable for filter-pressing. The added cost necessary to reduce the large tonnage of sand to pass 200 mesh would not be justified from the increased extraction point of view, while from the filter-pressing standpoint 150 mesh would be quite fine enough.

4. There can be no question that a plant designed to handle one product, and one product only, continuously, will be much more simple in design, less costly in capital outlay, and cheaper to work than the plant consisting of three separate parts.

5. There is nothing to be gained in recovering 50% by amalgamation: first, because the operation, though not an expensive one, costs something; second, it is always easier to steal gold caught on amalgamation than gold held in zinc-boxes; thirdly, the ultimate recovery is likely to be rather more than less without amalgamation as the losses arising from the use of that process are thereby avoided; fourth, the extra consumption of cyanide and zinc is almost inappreciable. For these reasons there is no object in using amalgamation.

6. Given that a clean concentrate can be made such as that indicated in the case under review, there can be little doubt that it would be wise to make as clean a concentrate as possible. For this purpose it would be necessary to use some mechanical device in order to ensure the saving of the bulk of the concen-

trate. It is possible to arrange for the re-grinding in such a manner that the reduction to impalpability can be absolutely assured.

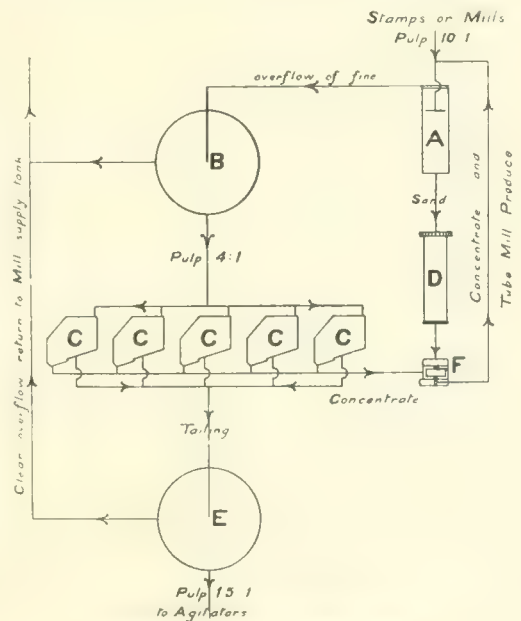
One of the great objections to rejecting amalgamation is that the coarse gold will offer such a resistance to a dilute cyanide solution that in all probability it would not be dissolved in the time provided. Those who raise this objection, however, overlook one important point: that the concentrate with which the coarse gold is associated is taken direct to tube-mills from which no escape of coarse gold is possible. In fact, once the coarse gold reaches the tube-mill its condition is rapidly changed to thin flaky gold and in this condition it offers little resistance to solution. I desire to emphasize this point as it has been so often raised and there is no doubt at all that in actual practice those who raise the objection will find that the difficulty will disappear. Of course, I assume that in the handling of the pulp as one product, cyanide solution would be circulated throughout the entire plant, in which case the coarse gold, after being thinned in the tube-mill, will pass from it in solution. In every case where the pulp can be handled as one product there can be no question as to the advisability of circulating solution throughout the entire plant. The advantages that accrue in the matter of saving of water, pumping cyanide solution, damming, etc. are too well known to require a detailed description here, but the principle is so important that it may be taken as the crux of all-sliding work.

In regard to the method of securing with certainty the thorough re-grinding of the concentrate I cannot do better than give the following brief description of the suggestions put forward by A. Grothe in a paper read by him before the Mexican Institute of Mining and Metallurgy.

"The ground pulp from stamps or mills, containing about 10 of solution to 1 of ore, goes to a Dorr classifier (A), the overflow from which is condensed in the pulp-thickener (B) to 4: 1, or any other proportion suitable to the kind of slime-table used. This overflow consists of particles all passing 150 mesh, only a small percentage being retained on 200 mesh. The coarser part of the pulp, constituting the underflow of the classifier, goes to the tube mill, or other re-grinder, with the proper degree of moisture. It contains the sand from which the precious metals have not yet been completely liberated, the pyrite and the coarser particles of silver sulphides and gold. The overflow of the classifier, after having been properly thickened in (B), is concentrated on

slime-tables (C). The concentrate from these tables, instead of being sacked and sold as usual, is returned to the pump (F), joined to the tube-mill discharge, and enters the classifier again.

"It will be seen that the concentrate is thus kept in circulation until so fine that it will not settle on the tables but float off by surface tension and is then carried with the tailing to the second pulp-thickener (E), which produces the proper density of pulp for treatment by cyanide in agitation-vats. The fineness of this concentrate, which, after repeated grindings, at last pass off with the tailing, surpasses anything that can be separated by the finest screens or by the overflow from cones or classifiers. In this state it will behave exactly as the metals in the ordinary pulp; the extraction will be completed in 24 hours or less; there will be no



Flow Sheet suggested by Albert Grothe

re-precipitation and the consumption of cyanide will be in proportion to the metallic contents of the ore.

"The objection might be raised that an accumulation of concentrate will take place on the tables, and that additional work will be thrown on the tube-mills. Both are no doubt correct to a certain extent, but accumulation will not proceed indefinitely, because, as more particles are presented to the grinding apparatus, a greater effect will be produced, and after a short time a state of equilibrium will be established and the quantity of fine concentrate

drawing off the tables will equal that of the coarse concentrate contained in the ore. As to the extra work thrown on the tube-mills, this cannot be correctly estimated, but supposing the ore to contain 2% of concentratable matter, which thus requires re-grinding, and that it were necessary to pass it 5 times through the mill before it is fine enough, then the loss of the capacity of the tube-mill would be 10%. The additional cost for re-grinding would therefore be insignificant when compared to that of disposing of the concentrate to the smelter or subjecting it to a special treatment.

"A further advantage of the system is that the action of the solution on the concentrate passing several times through the tube-mill is considerable, and shortens the time necessary for agitation. It can easily be tried and its economic value for every case determined, in any existing mill, without making important changes or the addition of expensive plant."

The main point made by Mr. Grothe is that it is necessary to make certain that the concentrate shall be reduced to the finest possible condition and the adoption of his suggestion gives an assurance that this end will be achieved. J. L. Mennell, in discussing Mr. Grothe's suggestion, pointed out that another advantage of the system lies in the fact that the concentrate is not re-ground alone. He states that unless mixed with sand the concentrate is apt to pack and cause difficulty in re-grinding, whereas when mixed with the sand the tendency to pack is obviated and simultaneously assistance in the operation is actually gained by such presence of the sand. Furthermore he points out that it also avoids the use and expense of a separate mill. The only disadvantage, according to Mr. Mennell, lies in the "diminution of the capacity of the tube-mill by the repeated handling of the same material," but this in his opinion is more than counterbalanced in the saving of the additional material requiring separate attention.

Another feature of this system is that the concentrate by repeated passage through the tube-mill gets a longer time of actual treatment than the ordinary pulp. This certainly is an advantage.

Every ore must naturally be treated on its own merits and according to the constitution of the ore so will practice vary; for instance, we may have any of the following conditions:—

1. An ore that could be concentrated to give 80% of its valuable contents to the concentrate, such concentrate not exceeding 10% of the total ore; in this case unless the ore were high-grade it would certainly be unnecessary

to re-grind anything but the concentrate and it would be a matter of experiment to decide whether a hydraulic classification would serve the purpose or whether mechanical concentrators should be employed.

2. An ore that contains practically no concentrate and in which the gold is distributed fairly evenly throughout; in this case it is exceedingly probable that after the first separation of the slime the rest of the pulp would have to be re-ground.

3. An ore containing a large proportion of pyrite with which only a portion of the gold or silver is associated; in this case the same practice would have to be followed as above.

4. An ore containing a small proportion of rich pyrite but still leaving considerable gold and silver in the pulp; in this case probably the most satisfactory procedure would be to resort to a hydraulic classification by means of spitzluten, with special re-grinding of the concentrate, and with auxiliary re-grinding of the remainder of the ore.

All of these cases will be found to occur in actual practice and each one must be judged on its own merits. It may be taken as axiomatic, however, that in every case where, either by hydraulic classification or mechanical concentration, a comparatively small proportion of the ore of relatively high value can be separated, it will prove expedient to make that separation and provide for a special re-grinding of that product embodying the "return" features set out in Mr. Grothe's suggestion. Of course, it is not a new idea to suggest the return of the coarser particles, and in fact the idea has been employed in grinding work for the past 20 years; it is clearly stated in Mr. Grothe's notes, however, and I deem it well worthy of emphasis.

The day of the percolation method of treatment for sand and the decantation system for the treatment of slime has gone, except in special cases, and it is only due to the persistence of some of the metallurgical fraternity who have been wedded to these ideas that they are today included so freely in the treatment of simple gold ores. There can be no logical argument opposed to the principles of the one-product treatment now becoming almost universal and the only points remaining for settlement are the methods and devices to be adopted in fine grinding and the degree to which this principle is to be pushed in order to gain the best results. Modern practice has so emphatically taken up the circulation of cyanide solution throughout the entire plant followed by fine grinding and filter-pressing, and the results have so abundantly

dantly demonstrated the fact that this practice is a great step forward as compared to Rand methods even of today, that there can be no longer any discussion as to the relative merits of the respective principles. The fight in future will lie rather in the finer points of the newer process than on the question of its superiority to old practice.

I venture to predict that the tendency of the future will be to crush in stages, classify, grind in stages, agitate, and filter-press on the one-product principle and I believe that the upshot will be cheaper plants, lower working costs, and improved extractions. Probably the unit vat-capacity of plants will be considerably increased, especially those vats responsible

PROSPECTING IN CHINA

By G. F. OBER

CHINA offers an inviting field to the prospectors, especially when one considers that in such a vast territory no paying gold mines are being worked. After spending from April to November of 1910 prospecting and operating in streams tributary to the Canton river, I offer this description of my journey, together with some photographs of the country. As to signs of mineral wealth, I can add that I saw many places inviting exploration. Hong Kong is a British seaport controlling the trade of the three southernmost pro-



Causeway to Sun Ning.



A river Junk.

for the feeding of the filter-presses. There is no reason why two big vats should not hold a three days' supply for a filter-press plant of 400 tons capacity and it will be at this end of the equipment that the storage reserve will be created rather than in the battery-bins. Air agitation has been so successfully used on pulp consisting of slime and fine sand that it is bound to continue to play an important part in agitation work, and although the shape of the Pac-huca tank may be considerably modified the principle upon which it is operated is bound to be recognized, and in some form or other it will be embodied in all new plants.

vinces of China—Kwong Tong, Kwong Si, and Yun Nan. Canton is the main Chinese trade centre, but it is dependent on Hong Kong, because ocean-going ships cannot come up the river to Canton; the transportation therefore of goods for the interior and also of ores to be shipped outward is done on river steamers of shallow draft and the loading is from docks similar to the one shown in the accompanying photograph. A comfortable steamer takes the traveller to one of the three Chinese sub-ports or *likin* stations (custom houses), namely Pak Hoi, or to Canton or to Woochow. Each is a distinct journey made

is a distance of five or six feet. I shall continue my trip to a description of the mineral district reached by way of Pak Hoi, as it is undoubtedly the richest in gold ore. Woochow is more of a centre for lead and antimony ores and Canton for copper, coal, and lime. The following sketch shows the route; by the completion of the French railroad into Yun Nan from the port of Hoi Phong another outlet, superior to river transport, will become available.

After leaving Pak Hoi trouble really commences, for only by rare luck will a white face be seen and to a certainty no European eating-house will be found. As the tide reaches up the river from this place for 60 miles, the Chinese take advantage of the volume of water in a river that otherwise would be too small for large boats, which are towed by means of steam-tugs. It is possible to obtain a good meal on these boats provided you can use chop-sticks or carry your own knife and fork. The termination of this boat trip lands you abruptly into the Chinese city of San Chong. From now on it is a matter of living on Chinese food and sleeping on a Chinese bed. To avoid this I equipped myself with a full camp outfit and engaged a number of Chinese for guides. It is always possible to obtain men as porters for the chair (like a Sedan) at 80 cents Chinese money per day or 35 cents gold. Our party encountered many vexations and it was not uncommon to be followed into the hills by two or three hundred Chinese residents. My reception everywhere was good and without exception the people were anxious to see me spend money and develop their minerals or to tell them how to do it.

I saw a promising outcrop of quartz, at the base of which some placer mining was in progress. No white man having been in this locality before my visit the work was being done in a very crude manner. This district is distant from water transportation and if machinery is required it will have to be carried in small sections. No wagon-roads are available and the zig-zag paths through rice fields can only be used by coolies on foot. However a railroad is now being constructed in the Sun Ning district by the Chinese themselves. It has been completed and is running for 36 miles. Much credit is due to the man at the head of it, Chin Gee Hee. The natives are enterprising and desirous of getting ahead. A number of boys from leading families are away at mining schools learning assaying and in the years to come they will aid in the development of the re-

gion. The entire southern portion of China is mountainous and largely of a granitic character. The Chinese cultivate the flats between the various peaks but make but little use of the hills except as burial places. I made enquiry everywhere as to the effect of the popular superstition, Feng Shui, regarding working mines under graves and without exception was told that for a small consideration the grave could be moved to another spot. Heretofore this has been a great factor in retarding mine development.

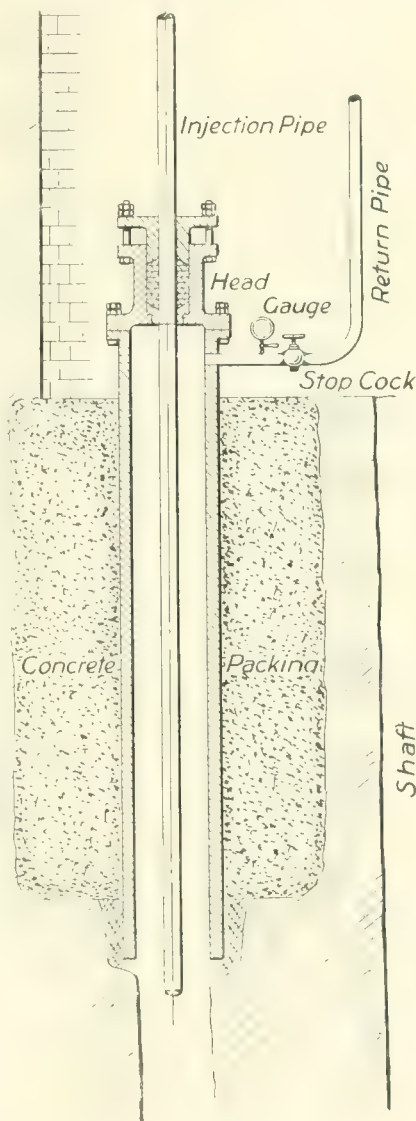
Sale of Zinc Ore at Joplin. The owners of a smelter naturally desire to obtain a regular supply of ore for their furnaces and to be free from the anxiety attending the continual variations in the price of the metal. The zinc concentrate produced at Broken Hill, for example, is sold to Germany on long contract, and the price to be paid for a year's deliveries is adjusted by the price obtained for the metallic product. A similar method has recently been proposed at Joplin, Missouri, by one of the buying associations connected with certain smelters, as a substitute for the old-fashioned system of public competition. So far, the proposal has not been received kindly by the mine owners, who do not care to commit themselves to a single buyer for any long period. Besides, some of the rival smelters came forward with extra favourable bids, and the new scheme, though founded on solid ground and based on long experience of the market, was temporarily at least upset. The proposed plan for buying ore on long contract was as follows: The standard price was made \$37 per short ton of blende containing 60% zinc, not more than 2% iron, and not less than $\frac{1}{2}$ % lead, this price to be paid when the quotation of zinc is 5 cents per pound at St. Louis. For every unit of zinc more an additional dollar would be given, and for every unit less a dollar deducted. For every increase of one cent in the price of zinc per pound, \$8.50 would be added, and for every similar decrease the same amount deducted. Fractional increases and decreases would be treated in proportion. If the iron unit was over 2% and under 5% there would be a penalty of \$1 per ton of ore, and a penalty of 50 c. for each per cent above five. If the lead content was less than $\frac{1}{2}$ % a premium of \$1 per ton would be granted. Unprejudiced authorities in America consider this arrangement equitable to both parties, and perhaps it may yet be adopted when the mine owners have become more familiar with its objects.

PRECIS OF TECHNOLOGY

Platinum in Copper Ores.—*Metallurgical and Chemical Engineering* for February describes the treatment of the platiniferous copper ores found at the Rambler mine, 50 miles southwest of Laramie, Wyoming. This mine has been worked for many years but it was only in 1901, after 4000 tons of 30% copper ore had been sold to the smelters, that the presence of platinum was suspected. The ores contained gold as well, but the owners of the mine were never paid for any of it. In 1901 tests at Henry E. Wood's laboratory at Denver showed that the copper minerals generally (not the undressed ore) carried from 0.1 to 0.7 oz. platinum per ton, and that the covellite carried from 0.4 to 1.4 oz. per ton. The investigations by Wells and Penfield proved that the platinum occurred as sperrylite, the arsenide of platinum, in very fine crystals. In the smelting of the high-grade ore the platinum was collected in the copper and recovered with the gold in the anode slime. This slime showed large contents, one lot assaying 226 oz. platinum, and 166 oz. palladium per ton. As long as the ore could be hand-picked the recovery would be fairly satisfactory, but the treatment of the lower grade ore presented difficulties and has been the subject of study for a long time. The mine contains a remarkable mixture of all sorts of copper minerals, native copper, oxides, silicate, carbonates, chalcopryite, chalcocite, covellite, and even atacamite (oxychloride) and chalcantithite (sulphate). These ores are closely associated, some coating the others, and the sperrylite and the gold is found in all of them, especially in the covellite. Experiments in concentration by David T. Day showed that if the ore were crushed to pass 2 mm. about half the precious metals would be recovered. The smelting of these ores is made difficult by the presence of decomposed diorite. Last year, a mill was erected on the advice and under the direction of R. A. Marr and A. C. Dart. The ore after crushing to $\frac{1}{2}$ in. is sent to rolls which reduce it to 20-mesh. It then goes to a 3-compartment classifier, and the three sizes are treated on three Wilfleys; the overflow goes to two canvas tables. The Wilfleys produce a narrow streak of high-grade concentrate containing the precious metals, a copper concentrate, and a combined middling and tailing which is being stored for further treatment, probably by leaching. The copper concentrate consists of sulphides, and the middling contains carbonates. Many details have still to be settled, but the results so far obtained are highly satisfactory. The paper also gives a detailed account of the methods used for assaying these ores.

Shaft-Sinking.—At the February meeting of the Institution of Mining and Metallurgy, A. L. Shrager described a method for sinking shafts through water-bearing strata adopted in the Lens district of the Pas-de-Calais coalfield, France. The method is not intended for use in shifting ground, and is only applicable where the strata are firm. The plan is to sink boreholes through the strata outside the circumference of the intended shaft and to pump cement down them. This cement permeates the fissures in the rocks and on setting forms a cylindrical wall through which water cannot enter the ground to be excavated. The strata at Lens are chalk, sandstone, and marl, and a typical section from the top is: earth to 16 ft., chalk to 65 ft., chalk and flint to 118 ft., sandstone to 131 ft., gray marl to 213 ft., and blue marl to 262 ft. A pit was sunk through the earth and lined with masonry, giving an internal diameter to the pit of 24 ft. 4 in. Six holes were then bored at equal distances apart

round a circle having a diameter of 22 ft. When passing through the harder rocks a churn drill was used, and when passing through the marl a rotary auger drill was employed. After boring downwards 3 ft. a lining case of steel $11\frac{1}{2}$ in. diam. and 2 in. thick was placed in the borehole, and firmly fixed in place by concrete packing. The drill stem consisted of a hollow steel tube $2\frac{1}{2}$ in. internal diameter, and it was used for the



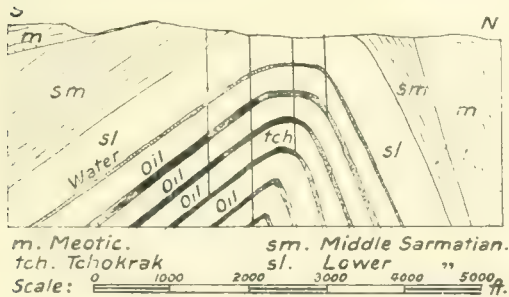
purpose of injecting cement. In some cases the holes would be sunk a few feet at a time, and then washed with water, and the dilute cement forced in; in others the whole length of the bore would be completed before the injection of the cement. The author gives details of the time occupied, cost of operation, and amount of cement required. He reports that the process is entirely successful, and that it rapidly gives a safe cylindrical body of rock that does not allow water to come into the shaft; also that the cost is low.

Hall's Aluminium Invention.—At the meeting of the American Electrochemical Society held in New York City, on the 10th of the 11th inst., a paper was presented on the subject of the Hall process for the production of aluminium. The presentation was made by C. F. Chandler, who is the doyen of the chemical industry of America and who has been intimately connected with the production of aluminium ever since 1854. He was the teacher of H. Y. Castner who subsequently started the process for the reduction of alumina by metallic sodium, and is also the friend of Paul L. V. Heroult who has done so much in connection with the invention of electric processes for the production of aluminium in Europe. Mr. Chandler was therefore admirably suited to be the speech-maker in connection with the presentation of the medal to Mr. Hall. The Hall patents have been in existence for a long time, so most people will be surprised to learn that the inventor is still a young man. He was born in 1863 in Ohio and graduated from Oberlin college in 1885. The course he took at this college was classical not scientific, thus affording another instance of the continual difference between teaching and achievement. He had studied as a hobby the chemical history of aluminium and had tried all the processes described by Woehler, Deville, and others. Owing to the great cost of the materials used by previous experimenters, Mr. Hall sought some other method, and applied the electric current which was then becoming an important industrial source of power. He decided that if an anhydrous solvent could be found that would dissolve alumina at a reasonable temperature the electric current could be used profitably. He first tried fluorspar, and then the fluorides of magnesium, sodium, potassium, and aluminium, but found that they were too infusible and that they did not dissolve much alumina. In February 1886 he tried cryolite, or the double fluoride of sodium and aluminium and found that it would dissolve 25% of its weight of alumina and would remain fluid at a comparatively moderate temperature. In July of that year, when only 22 years of age, he applied for a patent in the United States to cover this discovery. It was numbered 400,766 and was not granted until three years afterwards, in April 1889. He passed through the usual financial troubles that fall to the lot of inventors and many abortive arrangements were made for the starting of the process on a practical scale. From July 1887 to July 1888 his process was tried by the Cowles company of Lockport, New York, but as the process did not work well on a small scale owing to many injurious compounds being formed in the bath, the option was abandoned. Finally in 1888 people in Pittsburg took up the process and formed the Pittsburg Reduction Company. The plant erected by them had a capacity of 50 h.p. with a current of 2000 amperes. Curiously enough when working on this larger scale the troubles due to the formation of objectionable compounds and the consequent clogging of the bath did not occur, owing presumably to the fact that the electrodes were farther apart. Anyhow, whatever the explanation, the case affords an example of a process being successful on a large though not on a small scale, and may afford comfort to other inventors when confronted with difficulties in their initial experiments. He also found that no external heat was required for the purpose of keeping the bath in a state of fusion. The works at Pittsburg commenced with a production of 50 lb. per day and the result was so satisfactory that large works were built at Niagara Falls, and the company was the first customer for the current generated by the Niagara Falls

Lower Co. Another works was established at Massena in New York State on the St. Lawrence river, and one at the Shawangin Falls in Canada. The total power used at these three works is 140,000 hp. and the yearly output is 40 million pounds. The first metal produced in Pittsburg was sold at \$1 per lb. the price is now about 22 cents. At the presentation to Mr. Hall, Paul Heroult, who invented the process at practically the same time in France, gave reminiscences of his experience. The companies owning the Hall and Heroult processes fought for 15 years, but these disputes are now forgotten.

Geology of Petroleum.—Now that petroleum is receiving so much attention from mining engineers and investors in all parts of the world, the paper giving an outline of the geology of petroleum read before the Institution of Mining and Metallurgy on February 22 by A. Beeby Thompson is of timely interest. Petroleum is a mixture of an indefinite number of hydrocarbons, gaseous, liquid, and solid, occurring in a great variety of combinations. It is mostly found in strata of the Tertiary age and is never known in connection with igneous rocks except when these rocks have pierced shales that are rich in organic matter. Petroleum accumulates along the folds of the strata, especially along anticlines underneath impervious strata. It is impossible to say to what depth petroleum extends, because only the deposits sufficiently near the surface to give indications of their presence have been exploited. As a rule water mingles with the oil or saturates the beds in the vicinity of the oil; the oil being lighter naturally rises to the anticlines while the water gravitates to the synclines. The surface indications of petroleum are usually found at points of denudation of anticlines, where oil-sands are exposed or barely covered with surface deposits. Oil may be found oozing out accompanied by gas; sometimes the occurrence is asphalt, that is, oxidized petroleum mixed with both organic and inorganic matter. At first the connection of this pitch with oil was not suspected, and it was only by drilling below the pitch that the concealed oil demonstrated the origin of the pitch. In many cases the imprisoned gas finds points of weakness in the overlying strata and may cause such sudden outbursts as to change the shape of the country, or it may come out in gentler and serviceable streams. It is of course seldom that regularly undulating anticlines and synclines are found. As a rule the anticlines are not symmetrical and they are usually broken by faults. Also the folds may not always follow a straight course but the ridges of the anticlines may be sinuous, and the crests may rise and fall, thus making the distribution of the petroleum hard to follow. Secondary folding as a result of thrusts in a different direction from the primary line of thrust tends to produce domes, the occurrence of which is always sought by the geologist. A good example of a symmetrical anticline is the Yenangyaung oilfield in Burma which has yielded the chief supplies of that country. The most prolific of the oil-sands found there are much below the surface, embedded between clay deposits of the Miocene age. This oilfield exhibits a dome shape, the inclination on two sides being steeper than in the other two directions. The Bibi-Eibat oilfield of Russia also shows a dome shape. The strata are horizontal in the centre and then sink at a gentle angle in three different directions, the fourth side dipping under the Caspian not being available for research. The structure is also modified by faulting. In the Appalachian oilfield the oil is in porous sandstone alternating with shale. The strata are 2000 ft. thick and the dip is very gentle.

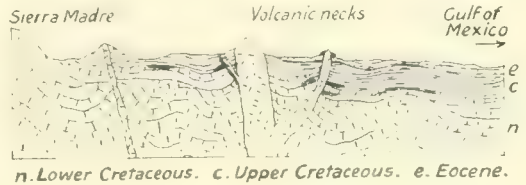
It is more usual to find the anticlines not symmetrical and an illustration of a characteristic occurrence is given herewith showing the formation of the Grosny oilfield in Russia. This oilfield also exhibits a dome shape. It is notable that in asymmetrical anticlines the crests of succeeding strata are not vertically beneath each other, so that drilling for successive crests has to be carefully managed. Similar formations are found at the Yenangyat oilfield in Burma and the Campina oilfield in Roumania. The oilfields in the proximity of mountain ranges generally exhibit more complicated folds, and ruptures and dislocations of the strata. At McKittrick, California, the strata are much contorted and are apparently hopeless, yet they have yielded large supplies. Some of the most complicated oil-bearing strata are found in Roumania. At several places in that country, for instance, Moreni, the oil strata rest on Miocene salt-bearing sandstone



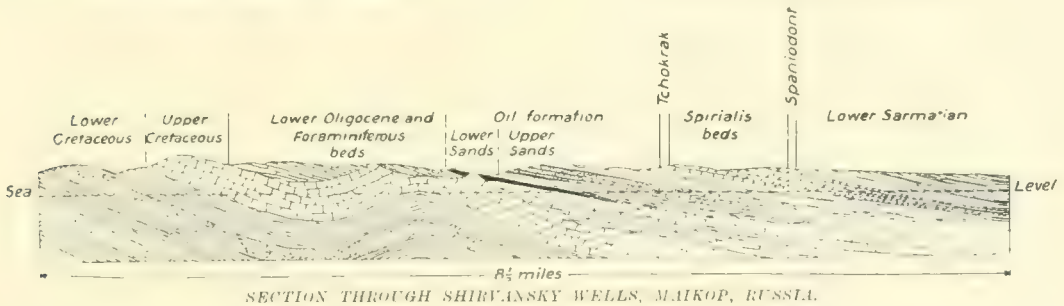
Section through Grosny Oilfield, Russia.

practicable limits, did not enter into a discussion as to the origin of petroleum, though he referred shortly to the migration of petroleum from the point of formation to the place where it is found, and to the fact that salt is almost always found in connection with it. The discussion at the meeting was excellent, and many speakers asked Mr. Thompson to elaborate on certain points. This he promised to do in writing, and we shall abstract this further contribution on publication.

Compressing Air by Falling Water.—In our issues of May and August last we described the Taylor system of compressing air by means of falling water and carrying it while contained in the water for considerable distances to mines where the air can be employed for working rock-drills and other plant. The installation we described was that at Cobalt, Ontario, and we mentioned that much inconvenience was caused by the air when released from the water being lower in oxygen than normal air. This circumstance has induced F. W. McNair and G. A. Koenig to present to the American Association for the Advancement of Science an account of their investigation into this



Ideal Section of Mexican Coastal Plain



SECTION THROUGH SHIRVINSKY WELLS, MAIKOP, RUSSIA.

which has raised and pierced the newer overlying oil strata. The association of oil with salt is also a feature of the Texas and Louisiana oil districts. Here are found domes on the surface showing occasional traces of salt and sulphurous gases especially along faults. At the Spindle Top district the oil came through a dome of this sort that is covered with an impervious capping. Geologists found that these domes have a central core of salt, gypsum, and limestone, and that all the strata even the most recent have been forced upward in the neighbourhood of the cores of salt. The geological explanation of this formation is not yet settled. The Maikop oilfield is of yet another type and may be called an unconformable monocline. As shown in the illustration inclined strata of Upper Oligocene and Lower Miocene age lie unconformably upon and overlap Cretaceous strata. In Mexico petroleum has in many cases accumulated against igneous dikes that have perforated the oil-bearing strata. The dikes arrest the ascent of the oil when the strata are inclined, thus causing accumulations.

The author, in order to confine his paper within

problem in connection with a similar installation at the Victoria mine, Ontonagon county, Michigan, in 1907. Difficulties had been experienced at this mine with the lights, and the authors made investigations into the whole subject. The fact that water dissolves more oxygen than nitrogen when in contact with air has been known for many years. Fifty years ago the principle was employed by a French chemist who wanted to get air for blast-furnace purposes rich in oxygen and adopted the method of passing air through water and then expelling the dissolved gas. In the hydraulic compression system the action is just the contrary to this, for it is the surplus undissolved air which is liberated and is used in the mine, and it is poorer in oxygen than the normal atmospheric air. When the authors commenced their inquiries they found three separate problems before them. The first was to ascertain the exact composition of the air released; the second was to find whether the deficiency in oxygen was the sole cause of the slow burning of the candles, and the third was to find whether the men suffered in any way.

The composition of the mine at a Hempel patent. The text-books record that a single solution of air in water contains 3.3 volumes of oxygen, a figure agreeing with experience at the Victoria mine and at Cobalt. At the time of the authors' investigations, the Victoria mine had only one shaft. It was 1,200 ft. from the surface. Some of the drifts were long, one breast being as far as 1,200 ft. from the shaft. Hardly any stoping was done as the mill was not then completed. Air from the hydraulic compressor was used for working the drills and for ventilating after blasting. The effect on the candles was studied by watching and photographing the flames at surface and below. At surface they burned with the usual long pointed flame. When lit below the flame was much shorter and quite blunt. The tail of both semiluminous and sooty carbon characteristic of the flame in the open air was absent. The cup was only meagrely supplied with melted wax and showed a frozen appearance round the edge. The flame would be easily extinguished by moving the candle sideways suddenly. Another point of interest was that an acetylene flame did not suffer any diminution of brightness or size. As regards the effect of the air on workmen no definite information was obtainable. The authors did not find themselves affected in any way whether their exertions were mild or violent. None of the men ever complained, in fact the men generally considered the atmosphere more congenial than when steam-compressed air was used.

Paragenesis of British Ores. In *Economic Geology* for December, A. M. Finlayson contributes a study of the order of deposition of ores in Great Britain relatively to each other. The method of investigation was by means of polished specimens in reflected light and by thin sections when the minerals were transparent. The author divides the veins in Great Britain, other than those of oxides and carbonates of iron, into three well-marked types: (1) tin-tungsten veins with chalcocopyrite, a phase having pneumatolytic associates; (2) a copper phase of deep sulphides often accompanied by rare minerals; (3) and lead-zinc veins, associated with fluorspar, calcite, and barite, widely distributed and forming a phase of shallow sulphides. No. 2 is a transitional phase bridging the gap between the other two.

Of the minerals in the tin-tungsten phase the two earliest are apatite and magnetite. Apatite occurs usually in prismatic crystals which may be enclosed by magnetite, tourmaline, or cassiterite. Cassiterite is sometimes found moulded on apatite and fine needles of apatite are frequently enclosed in magnetite. The steel-gray magnetite, which may develop a gridiron structure with polishing, generally occurs in isolated grains and crystals, but both tourmaline and cassiterite may be observed deposited round it. The next in order of deposition are cassiterite and tourmaline. These two are sometimes intergrown and appear to be practically contemporaneous, though they tend to crystallize separately. Fluorspar is generally later than these two. It has a tendency to develop by metasomatic replacement and is seen sometimes replacing apatite. Wolfram in most cases follows cassiterite and is seen deposited on it as well as on apatite and magnetite. Small cassiterite needles may be seen enclosed in crystals of wolfram; one specimen prepared by the author showed threads

of wolfram penetrating and partly replacing magnetite. Scheelite appears to be almost always of metasomatic origin. The sections sometimes showed residual grains of apatite enclosed in it and in other cases it is deposited on apatite. When wolfram and scheelite occur together, the latter generally spreads along the cleavage planes of the former. Arsenopyrite is associated with nearly all the other ores in the veins. It is generally deposited on the heavy minerals and is distinctly later than cassiterite and wolfram. It is the characteristic sulphide of the pneumatolytic phase and connects the ores of this phase with those of the succeeding copper phase.

Chalcocopyrite is the characteristic mineral of the copper phase. Pyrrhotite accompanies it sometimes, also arsenopyrite. Sometimes pyrite is the dominant sulphide. Rare minerals such as pitchblende and the sulphides of bismuth, cobalt, and nickel are occasionally associated with it, especially in Cornwall. When pyrite is present in quantity it is usually the earliest of the group. In the dense pyrite in Avoca, Ireland, chalcocopyrite is found as grains and irregular strings running through the mass; in this ore galena and blende are also found deposited on or enclosing pyrite. Except when occurring in massive form, pyrite is one of the last formed and the least abundant in this phase and in the lead-zinc phase. Arsenopyrite is one of the later minerals of this phase and is found enclosing chalcocopyrite. Microscopic examination sometimes shows grains and partly-formed prisms of pale arsenopyrite replacing massive corroded pyrite. Pyrrhotite is earlier than chalcocopyrite. It occurs in irregular grains and masses enclosed in chalcocopyrite and is frequently traversed by strings of chalcocopyrite along minute fractures and in solution-cavities.

In the lead-zinc phase the characteristic minerals are galena and blende with some chalcocopyrite. The gangue minerals associated with it are calcite, quartz, fluorspar, and barite. Chalcocopyrite is the oldest of the sulphides. It occurs in well-formed crystals upon which the other two sulphides are moulded. Frequently granular masses of galena and of blende enclose scattered crystals of chalcocopyrite. Blende and galena are often much intergrown and show variable relations. In most cases blende is the older and usually occurs as rounded or corroded crystals enclosed in galena. When pyrite, marcasite, or arsenopyrite are found with blende and galena they are generally in the form of crystals deposited on the other sulphides; they do not appear to be primary but the result of later secondary processes. Of the gangue minerals, quartz and calcite occupy no definite paragenetic position, but appear to have been deposited at many different periods. This is specially noticeable in the limestone veins where the calcite gangue is found to be a primary filling and also a filling after subsequent rearrangements of the veins. Barite appears to have been contemporaneous with galena and blende. The most notable fact in connection with this mineral is that when it is found in large quantities the amount of galena is correspondingly small, and *vice versa*. It is therefore probable that the two were formed together and that the local conditions favouring the deposition of one were unfavourable to the deposition of the other. As regards fluorspar, in this phase, it is a metasomatic mineral and is practically confined to those veins which traverse limestone or other calcareous rocks, where it is seen spreading through the gangue and adjoining country rock. Its priority to galena is proved by its replacement by the latter. This method of deposition of galena is often detected under the microscope, especially when the

fluorspar has been crushed or fissured by earth movements. Galena in these cases is found as scattered grains along these fissures, gradually replacing the fluorspar and forming a compact mass of granulation.

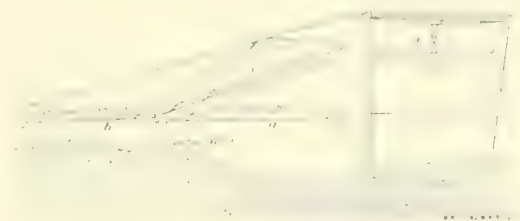
In summing up his conclusions, Mr. Finlayson considers that his division into phases and his deductions as to order of deposition fairly represent the facts disclosed by microscopic examination. The only element of uncertainty is introduced by the difficulty of deciding between primary and secondary processes, especially in the case of pyrite and arsenopyrite. A point of interest is the persistence of fluorine, from the earliest apatite to the much later fluorspar; this supports the view that the ores have all been derived from one process of magmatic extraction, the magma being probably granite.

Galafatite.—In our February issue we made short mention of a new mineral discovered in Spain that it was claimed would yield supplies of alumina and a potassium salt. Further information is supplied by Nordal Preus, of Madrid, in the *Engineering and Mining Journal* for February 4, but the account is not a good one. It is stated that the mineral is quite new and that it is a sulphate of potassium and aluminium. It is obviously alunite, a mineral known in Europe ever since records have been kept, and its occurrences in America more recently described. The author (or the editor and printer) states that the composition is $77.80\% \text{K}_2\text{SO}_4$ and $22.20\% \text{Al}_2\text{O}_3$. The total of these percentages is a great deal more than 100, and we may take it that 77 might be 37. Without the correction it is conceivable that the mineral warrants a new name. The description of the physical and chemical characteristics of the mineral given by Mr. Preus shows that it is not much different from the known occurrences of alunite. The specific gravity is 2.75, and the hardness is 3.5. It has a conchoidal fracture. It does not dissolve in water, or in acids at the ordinary temperature. On heating it will dissolve slightly in hydrochloric and sulphuric acids. After fusion with bicarbonate of soda it is easily attacked by hydrochloric acid. The proposition is to calcine or roast the mineral for the removal of water and of some of the sulphur; and it is claimed that sulphate of potash will then be easily removed by lixiviation, and a practically pure alumina will remain. Whether this description is reliable or not we have no means of determining. The deposit is situated at Benahabux, 10 miles from the port of Almeria, in the south of Spain. The mineral is stated to be found in several parallel lodes each 5 to 6 ft. wide.

Electrolytic Deposition of Lead.—In a paper read before the recent meeting of the American Electrochemical Society, F. C. Mathers read a paper describing the electro-deposition of lead using a perchlorate electrolyte. The well-known method of A. G. Betts employs a fluosilicate electrolyte, and by the admixture of gelatine the deposit of lead is made dense and uniform. Mr. Mathers finds that perchlorate, with gelatine, peptone, or other similar organic substance, will produce a similar homogeneous deposit. Perchlorate has several advantages: it is highly soluble, so there is no danger of salts crystallizing when the solution is concentrated; it is not decomposed by boiling, by acids or by alkalis. Air and nascent hydrogen have no effect on it. It does not attack glass or earthenware, and the solution has a high conductivity. Sodium perchlorate is used as the source of the perchloric acid. The right current density depends on several circumstances. With a content of 5% lead, 5% perchloric acid, and 0.05% peptone, the current density will be 2 to 3 amperes per square de-

cimetre. With baths containing only 0.2% free perchloric acid a good deposit may be obtained with 0.4 amperes per square decimetre. The experiments so far conducted have only been on a laboratory scale.

Restoring Dredged Ground.—Since the California dredging companies adopted means for restoring their ground after dredging to a condition once more fit for agricultural purposes, practice in connection with this matter in other parts of the world has interested American and other dredging experts. An article by A. S. Atkinson appearing in *Mines and Minerals* for February describes the methods used in Victoria, Australia. At three different places in this state satisfactory results are being obtained, namely on Crooked River, on Livingstone Creek, and at Eurobin on Owens river. In these districts the material is of a loose, friable, and sandy nature, so that the tendency has been to discard screens and elevators in favour of riffle-bottomed sluice-boxes. The top loam and the gravel are kept separate. Some part of the gold is caught on cocoamattings laid on the sand launders. If much clay is in the earth this method requires modification. One method is to pass the material through revolving screens inside which are loose chains and internal spikes for the breaking up of the clay. The accompanying sketch gives an idea of the method of discharging the tailing from the dredge. The main sluice-box (a) is 4 ft. wide, 18 in. deep, and 56½ ft. long. There is an opening 5 ft. wide between the lower end of the main sluice box and the upper end of the extension



loam-laundry (b). The latter is of the same width as the main launder at its upper end but it gradually tapers to less than half its width and depth. When loam is to be returned, a detachable chute is swung down to bridge over the space between the main sluice box and the extension. Thus the loam and gravel are redelivered separately with the former on the top. As little water as possible is used in treating the top soil, so as not to wash away the finer and soluble constituents, and various devices are adopted to as far as possible prevent the liquid loam being lost. This method of treating the ground is satisfactory to the farmers and there is now no conflict between the two industries.

Electrolytic Iron.—In our issue of September last we gave a short notice of C. F. Burgess' work at the University of Wisconsin in connection with the production of pure iron by electrolysis used by him for investigating the properties of iron alloys. In January he read a paper before the American Chemical Society suggesting the use of electrolysis for the refining of iron on a commercial scale, especially for the elimination of certain elements reduced with the iron from ores at present inapplicable for steel-making. The question of cost is the chief point on which the proposition hangs. His experiments have shown that by using an electrolyte containing 40 grammes of iron per litre in the form of ferrous sulphate, together with 40 grammes of ammonium chloride, it is possible to conduct a continuous refining operation with a cur-

current is 10 to 15 amperes per square foot of cathode surface, but a potential difference of about 1 volt. The current efficiency is not far off 100%, as it is in copper refining. This leads to the calculation that about 1 lb. of iron will be refined for every 1 lb. of iron consumed. Taking the price per unit at 4d., probably labour, maintenance, etc., would cost another 4d. per lb. would be 8d. 10s. The purity of the iron produced will be a few hundredths of one per cent. less.

Triboluminescence.—In 1891, the triboluminescent property of some specimens of zinc sulphide of emitting sparks when scratched. At the Chicago meeting of the American Electrochemical Society, W. S. Andrews described laboratory experiments undertaken for the purpose of producing artificial zinc sulphide which would exhibit this characteristic. He mixed 70 parts of pure powdered zinc carbonate with 30 parts of flour of sulphur, and added a dilute solution of sulphate of manganese so as to make a thick paste. This was thoroughly triturated in a mortar and then dried in a glass or earthenware dish at a moderate heat. When dried it was ground to a fine powder, packed into a porcelain or fire-clay crucible having a tight cover, and subjected to a bright red heat for 20 minutes. The result was that the mixture shrunk into a hard stony mass, which when scratched emitted a train of yellow sparks. These sparks were not of such a physical nature as to set light to inflammable gases. The compound produced in the way described by Mr. Andrews is undoubtedly similar in characteristics to those natural sulphides of zinc that exhibit luminescence when scratched, and his investigations should help to explain the nature of this comparatively rare phenomenon.

The Fairchild Magnetic Separator.—In *Metallurgical and Chemical Engineering* for February, H. C. Parmelee describes the system of magnetic concentration of complex zinc-lead-iron sulphides adopted by O. H. Fairchild at the Wilson mines near Robinson, Summit county, Colorado. The magnetic separator is somewhat similar to the Wetherill, but it has a distinctive feature, in that the magnets under the belt are arranged with alternate polarities. The result is that the material clinging to the belt is made to shift its position on passing above the alternate poles, and a shaking motion is thus obtained which releases the non-magnetic particles. The ore after drying is given a magnetic roast and is then passed down an inclined metal tray which is given a shaking motion. Across the tray are three transverse travelling belts under which the ore successively passes. Above each belt is a series of electro-magnets having their poles arranged alternately. The magnets over the first belt pick up the most magnetic material and the second and third belts have stronger magnets under them that remove the less magnetic particles. There are five of these separators each capable of treating 25 tons per day. The ore removed consists of pyrite which is sold to lead smelters for fluxing purposes; it contains some lead, gold, and silver which add to its saleable value. The ore unaffected by the magnets contains the galena and blende, together with silicious gangue; this goes to Wilfley and Card tables for the separation of the lead and zinc. The iron concentrate removed by the magnets assays 46% iron, 3% zinc, 2.2% lead, 6½% silica, 4½ oz. silver, and 1 dwt. gold. The zinc concentrate assays 41 to 42% zinc, 6% lead, 7% per cent silica, and 8 oz. silver. The lead concentrate assays 67% lead, 6% zinc, and 34 to 38 oz. silver.

The tailing carries 9% zinc, and 1.2% lead. The original ore assays 10.4% lead, 14.8% zinc, 1 oz. silver, and 14 dwt. gold.

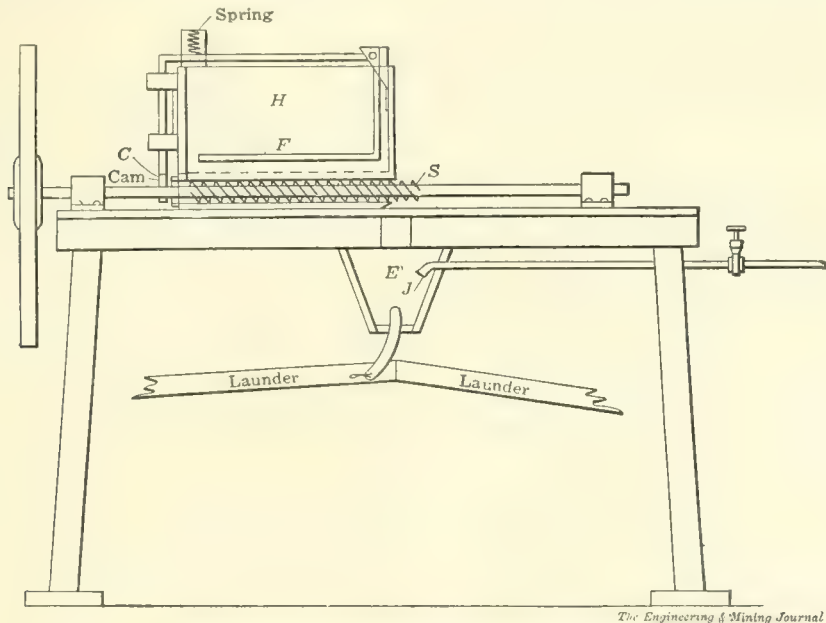
Feeding Zinc-Dust.—In the *Engineering and Mining Journal* for February 1911, Charles E. Knickerbocker, a screw feeder for the zinc-dust used in the Merrill precipitation plant at the Montana-Tonopah, Nevada, and the Central Mine, Grac Valley, California. The feeder sits at a convenient place in the plant, and is connected to the cyanide plant at the first mentioned mine. In the Merrill process zinc-dust is fed by a belt to an emulsifier which thoroughly incorporates the dust with the solution. In practice at the two above mentioned mines the use of the belt was found to be disadvantageous for two reasons. In the first place, in order to get a sufficiently regular feed, the zinc must be spread in a very thin layer; this means having a long belt and the consequent occupation of too much space. Second, if the zinc dust happens to get wet, so much heat is evolved as to cause a chance of fire. In Mr. Bosqui's apparatus these two drawbacks are eliminated. The zinc-dust is contained in a hopper (H), and is kept from packing by an oscillating arm (F) operated by a cam and spring. The dust falls through a slot and is carried along by the screw (S), and discharged in a continuous stream into the emulsifier (E). The emulsification is effected by a spray of barren solution issuing from the jet (J) and striking the bottom of the box at an angle of 45° at the same point as the falling dust. The pressure of the jet is 40 lb. per square inch. The discharge pipe from the box may be turned to any of the launders that lead the emulsion to the gold solutions. The rate of feed of the zinc-dust is regulated by a series of cone pulleys driven from the shaft which also drives the solution pump.

Origin of the Rand Deposits.—The retiring president of the Geological Society of South Africa, R. B. Young, gave in his valedictory address in January a resumé of our present knowledge with regard to the origin of the Rand gold deposits. It is now generally agreed that the banket is a littoral marine deposit. The Witwatersrand system was laid down in an area in which the general movement was one of subsidence, with a gradual encroachment of the sea on the land. The bands of quartzite, which are ripple-marked in places, and the beds of conglomerate indicate periods of pronounced shallow-water conditions. There are signs of contemporaneous erosion, and these form the ground for the opinion, which is occasionally expressed, that an unconformity exists in the system. It follows, from the fact that the conglomerates of the Main Reef series are underlain conformably by several miles of sediments, that these beds, where they are now being worked, must have been distant many miles from the ancient land from which their material was originally derived, and the term 'beach-deposits' sometimes applied to them is probably misplaced. The precise conditions under which the Main Reef series was laid down are difficult to reconstruct in imagination.

Of the rocks that formed the land in Witwatersrand times we can form some notion from the composition of the banket and other rocks, without drawing upon our direct knowledge of the Swaziland system. It is evident from the pebbles of the banket that they comprised quartzites, banded slates, and schists (for schist pebbles, though rare, do occasionally occur). Quartz grains, in the matrix, enclosing apatite and other minerals, indicate igneous rocks, while pebbles of vein-quartz and quartzite, containing abundant tourmaline, and others composed entirely of that mineral, suggest acid intrusions. The author mentioned that pebbles of what appears to be altered

quartz-porphyry are common in some portions of the 'reefs,' though no one has hitherto referred to their presence. The abundant microcline, orthoclase and acid plagioclase felspars in the 'speckled bed' are evidently derived from the disintegration of granite. The widespread occurrence of chromite in the matrix of the banket suggests basic igneous rocks. The commoner pebbles inform us that the country was intersected by numerous quartz veins. From the base of the system upwards the same types of vein-quartz pebbles occur, and the variations that can be observed in the other pebbles indicate the varying character of the rocks coming successively within reach of the ever-encroaching sea. It can be inferred from the nature

sumes present some difficulty, whether we adopt the infiltration or the placer theory, but especially in the case of the latter. Some of the pyrite occurs as minute rounded particles, which have obviously been in the rock previous to the production of the abundant secondary mineral, chloritoid, as the latter, when it occurs in contact with these grains, is moulded upon them. This form of pyrite is different from that in which it usually occurs in quartz veins, and calls for some explanation. Becker, in his exposition of the placer theory, assumed that these grains owed their shape to attrition, and were deposited contemporaneously with the pebbles. But this is merely substituting one difficulty for another, for the conditions of sedimentation



LOSQUET'S MACHINE FOR FEEDING ZINC DUST

of the rocks that formed this ancient land, and the different degree in which they resisted disintegrating agents, that the land presented a diversity of feature in some degree comparable to what can be seen at the present day in areas occupied by rocks of the Swaziland system.

The most conspicuous change that has affected the rock since its original deposition is cementation. From microscopic examination it can be inferred that the interstices were filled with secondary quartz, and that later some recrystallization occurred, in the course of which the outlines of the original quartz grains were almost entirely obliterated. The quartz pebbles retained their individuality, though their borders have been affected in various ways. The rock shows conspicuous signs of having been subjected to considerable strain, in the course of which, secondary minerals, especially chloritoid and sericite were produced. The rock, too, has been influenced by the numerous igneous intrusions, and the most obvious alteration brought about in this way is the introduction of abundant chlorite in the vicinity of basic igneous rocks, causing a darkening of the colour of the banket and associated quartzites.

The presence of pyrite and the forms which it as-

sumes must have been very abnormal to permit of the rounding and deposition of so brittle and easily oxidizable a mineral as pyrite in an unaltered state. On these and other grounds, J. W. Gregory, who also adopts the placer theory, refuses to accept this explanation, and assumes that the rounded grains are pseudomorphous after black iron sands, the source of the sulphur being sulphuretted hydrogen produced by the decomposition of organic matter, originally present in the finer associated sediments. The theory generally adopted by the infiltrationists is that the rounded pyrite owes its form to concretionary growth, though it has been suggested that it is pseudomorphous after some detrital mineral, the pseudomorphing agent being the solutions, to which, according to the infiltration theory, the metallic contents of the banket are principally due. The origin of these rounded grains of pyrite is therefore still uncertain.

A large proportion of the pyrite occurs as crystals and crystalline aggregates of varying size, with which may also be classed the rounded bodies of iron sulphide, often referred to as 'pyrite pebbles.' This class of pyrite is of different origin from the other already described. In most cases microscopic examination reveals the fact that it is of metasomatic origin,

ments of the banket is the result of extensive solution and recrystallization of the rounded pyrite. Whatever theory is adopted, whether infiltration or placer, reprecipitation of pyrite throughout so ancient a rock

The so-called pyritic pebbles have played a prominent part in discussions regarding the banket. They occur not only in the bankets of the Witwatersrand system, but also in those of the Elsburg and Black Reef series. A careful study of those found in the Kimberley series and the Du Preez reef series reveals clearly that they are of late concretionary origin, and, though the occurrences in other stratigraphical horizons have not been subjected to the same investigation, it appears not unlikely, judging from their general resemblance, that all of these bodies have had the same origin. It is extremely improbable that any of them are actually pebbles of pyrite, and further evidence than their external form will have to be produced before it can be conceded that Gregory is correct in assigning to some of them a pseudomorphous origin after ironstone pebbles.

The other metallic sulphides, such as pyrrhotite, chalcopryite, arsenopyrite, sphalerite, and galena, though present in much less quantity than pyrite, taking the banket as a whole, sometimes occur locally in considerable amount, and are always, like the second generation of pyrite, of metasomatic origin, being replacements of quartz. They are usually most conspicuous in the vicinity of basic dikes. Gregory assumes that they are of alluvial origin.

Support for the placer theory was at one time derived from the supposed presence in the banket of alluvial flakes of gold. It is now acknowledged that there is no such occurrence, and that the gold assumes identically the same forms as in quartz veins. If alluvial gold ever existed in the banket it must have undergone solution and re-crystallization, and in the course of this process a certain amount of redistribution must have taken place. In cases where gold has been observed in the pebbles, a study of the occurrences has always shown that the metal has been introduced subsequently to the formation of the banket.

Only the occurrence of the comparatively coarse gold, such as is found in very rich specimens of banket, can be satisfactorily studied by the microscope, and generally this gold is found to be associated with metasomatic changes in the matrix of the banket, and to be of late origin. This may be explained by supposing that it was introduced into the rock from some outside source at a late period, or that it is the result of the solution and segregation of gold previously distributed more finely within the banket or associated rocks.

The average fineness of the gold in the banket has been put at 875, the remainder being practically all silver. There are deviations from this average, and the indications are that the coarser gold is freer from silver than the fine-grained. If this is supported by fuller investigations, it will serve to confirm the validity of the classification of the gold into two distinct generations, previously made by the author, though based on entirely different grounds.

Mr. Young also dealt with carbon in the banket; a subject treated in C. B. Horwood's paper.

Carbon in the Rand Banket. The occurrence of carbon in the banket of the Witwatersrand system has been discussed by C. B. Horwood in his paper, "Carbon in the Banket of the Witwatersrand." He has shown that the carbon is of two kinds, one being the so-called "free" carbon, and the other being the "bound" carbon.

The "free" carbon is found in the banket of the Randfontein mines, in which the occurrence of carbon is most pronounced. In both cases the ore richest in gold is distinguished by the presence of carbon, in association with iron pyrite. In the Bucksshot Reef at Rietfontein the carbon is found in small specks on the surface of nodular pyrite and in the matrix. This pyrite under the microscope is seen to have replaced the quartzitic matrix of the conglomerate. Thus he infers that the pyrite and the gold were introduced from the same solutions. Another small seam, called the Carbon Leader, is characterized by carbon in small spheroids or flat round flakes up to 1.25 mm. diameter along a well defined parting. Occasionally, however, the carbon exists along cracks across the bedding. Here also the carbon is indicative of the presence of gold, which has been found not only as a film on particles of carbon but actually imbedded within the carbon, especially when in close association with pyrite. In the West Reef at Randfontein he noted that wherever carbon can be seen there also free gold, in a finely divided state, can be found. Such carbon lies around the edges and even along cracks within the pebbles of the banket. The Leader, another smaller seam, is characterized by coarse crystalline gold and carbon; in some specimens both exhibit columnar structure at right angles to the bedding of the conglomerate. Mr. Horwood lays stress on the intergrowth of the carbon with the gold, the latter not only occurring as a film around the carbon grains but in the form of particles entirely surrounded by carbon.

The first idea was that this carbon was deposited with the banket before the gold was precipitated and that it exerted a reducing action on the gold-bearing solutions, but Mr. Horwood argues that the connection is not merely chemical but genetic. The rounded flakes of carbon scattered along both sides of a parting in the conglomerate remind him of the flat crystals of tourmaline, of undoubted pneumatolytic origin, to be seen in the red granite of the Bushveld. He is convinced that the carbon is of deep seated origin and is derived from an eruptive magma. Hints of this he finds in the stronger and persistent diabase dikes traversing both the Rietfontein and Randfontein mining areas. In the West Reef dike at Randfontein he detected carbonaceous matter. Again, while the Rietfontein dikes contain carbon they also contain gold, except where decomposed near the surface, as if the gold had been leached out of them. Careful sampling of the West Reef dike at intervals from 160 ft. to 2080 ft. underground, proved that it contained from 0.02 to 0.22% carbon. The Rietfontein dike also was tested and from 0.03 to 0.2% was found in this diabase. Thus to the diabase is ascribed the origin of this carbon by reasoning analogous to that by which the Ventersdorp diabase has been credited as the source of the Vaal River diamonds, another form of carbon. Mr. Horwood proceeds to impute the source of both gold and carbon to the diabase. He found that the carbon or amorphous graphite in his specimens yield oil and thus showed the presence of hydrogen. He concludes that the carbon is of inorganic origin and connected with magmatic emanations. It is closely associated with the gold and the pyrite, both of which he also traces to the neighbouring igneous rocks. Thus he advances a well reasoned thesis for the pneumatolytic origin of the carbon, the pyrite, and the gold.

CURRENT LITERATURE

Stope Measurements.—In the December issue of the *Journal* of the Chemical, Metallurgical and Mining Society of South Africa, J. J. Bristol, of Reno, Nevada, contributes a discussion on O. Tonnesen's paper on a new method of measuring the work done in stopes, that was published in the Society's *Journal* for May 1909.

Deflection of Plumb-Lines in Shafts.—In the *Engineering and Mining Journal* for February 11, George C. McFarlane discusses the deflection of plumb-lines in shafts, caused by air currents.

Steel Timbers.—In *Mines and Minerals* for February, R. B. Woodworth, one of the Carnegie Steel Co.'s engineers, writes on steel timbers for coal mines. Steel has only recently been introduced in America for supporting roofs in mines, but was used as long ago as 1875 in England.

Grading Analysis.—In the December issue of the *Journal* of the Chemical, Metallurgical and Mining Society of South Africa, H. Stadler replies very fully to the discussion on his paper published last year by this Society and by the Institution of Mining and Metallurgy on the application of the analysis of the size of the feed and the discharge to the calculation of the relative efficiencies of the various crushing machines. This reply forms an important addition to his original paper, which was abstracted in our issue of June 1910.

Bullion-Refining at Mount Morgan.—In the August issue of the *Proceedings* of the Australasian Institute of Mining Engineers, there appears an article by H. S. Bohm on the process used at Mount Morgan for refining the gold bullion obtained at the chlorination works. The oxygen process is employed, and the author compares the results with those obtained by T. K. Rose at the Royal Mint.

Cyanidation in Costa Rica.—In the issue of the *Mining and Scientific Press* for January 28, S. F. Shaw describes the cyanide practice at the Montezuma mines in Costa Rica, Central America. These mines are situated 15 miles from Punta Arenas, a port on the Pacific coast. They have been worked for many years, but in 1908 modern plant was erected. Crushing is done in cyanide solution and the ore is slimed in tube-mills and treated in Pachuca vats and Butters filters.

Slime Treatment.—In the *Engineering and Mining Journal* for February 11, Arthur C. Nahl describes his apparatus for decanting slime, used at the Progreso mine, Lower California, in connection with the treatment of low-grade oxidized silver ore.

Clancy's Cyanide Process.—In the *Mining and Scientific Press* for February 18, D. Mosher, of San Francisco, disputes J. C. Clancy's claim for the use of cyanamide as a cyanogen-bearing substitute for ordinary cyanide.

Cyaniding Concentrate.—In the *Engineering and Mining Journal* for February 18, A. B. Parsons describes the method of extracting gold from pyritic concentrate at Goldfield Consolidated, Nevada.

Determination of Zinc.—At the meeting of the Australasian Institute of Mining Engineers in August last, R. T. D. Williams, of Broken Hill, read a paper describing experiments undertaken with the object of ascertaining the mean error, usual or possible, when determining zinc by ferrocyanide in hydrochloric acid solution. The author describes the method adopted at the De Bavay plant for carrying out this process.

Progress in Lead and Copper Metallurgy.—In the *Mining and Scientific Press* for January 7 and 28, L. S. Austin reviews the progress in lead and copper smelting during 1910.

Tennessee Blast-Furnaces.—The February *Bulletin* of the American Institute of Mining Engineers contains an article, by N. H. Emmons, on the alteration of the blast-furnace tops at the smelter of the Tennessee Copper Co., rendered necessary when the company commenced the manufacture of sulphuric acid from the blast-furnace gases.

Analysis of Aluminium Alloys.—In *Metallurgical and Chemical Engineering* for February, Thorn Smith gives methods of estimating aluminium in its alloys. He rejects the usual text-book method of using ammonia as precipitant, and shows that owing to the absence of a reliable method of direct estimation when the aluminium content is high, it is necessary to estimate the other elements and obtain the result by difference.

Nitrogen.—*Metallurgical and Chemical Engineering* for February contains a translation by Mark R. Lamb of a paper by E. Lamy read before the French Chemical Society on the fixation of atmospheric nitrogen. This paper contains the most elaborate and detailed account yet published on the subject.

Kolchan, Siberia.—In the issues of the *Mining and Scientific Press* for February 4 and 11, C. W. Purington describes in detail the Kolchan gold placers near Nicolaievsk, adjacent to the Okotsk sea, Eastern Siberia, giving details of the nature and origin of the deposit and of the methods of prospecting and testing. This property belongs to the Orsk Goldfields, an English company.

Etheridge, Queensland.—The *Queensland Government Mining Journal* for January contains a report by E. O. Marks, Assistant Government Geologist, on the Oaks and the Eastern Etheridge Goldfields. Amongst other things the report contains an illustrated description of the copper mine now being worked by the Einasleigh company.

Chibougamou Mining District.—The *Canadian Mining Journal* for February 1 and 15 gives a lengthy abstract of the preliminary report on the Chibougamou district in Quebec, prepared by A. E. Barlow, J. G. Gwillim, and E. R. Faribault. This district is situated to the north of the divide and is approached by the Quebec and Lake St. John railway as far as Roberval, and afterwards by trail. Gold has been discovered in copper-bearing quartz veins enclosed in pre-Cambrian rocks.

Porcupine Minerals.—In the *Canadian Mining Journal* for February 15, John Stansfield, of the department of geology, McGill University, gives the results of microscopic examinations of typical specimens of rocks and vein matter found at Porcupine.

Bisbee, Arizona.—In the *Mining and Scientific Press* for February 4, William L. Tovote reviews the geology of the Bisbee copper district, Arizona, extending F. L. Ransome's classical account written ten years ago.

Iron Ore in Swedish Lapland.—*Economic Geology* for December publishes a paper by Per Geijer on the geology of the iron ores found in the igneous rocks at Kuriinavaara and Gellevar, Swedish Lapland.

Occurrence of Chrome Ores.—The quarterly *Bulletin* of the Imperial Institute, No. 4 of 1910, contains the second part of an article mentioned in a previous issue on the distribution and utilization of chrome ores. The part now published describes the occurrences in Africa and Australasia and gives an outline of the methods of preparation and of the uses.

BOOKS REVIEWED

The Mining Manual, 1911.—By Walter R. Skinner. Cloth, 8vo. 1500 pp. London: W. R. Skinner. Price 15s. For sale by *The Mining Magazine*.

We have several times referred to the excellent series of books of books published during the last year or two by Walter R. Skinner. This present book on the geology of building stones is quite equal to the others in merit. The author is thoroughly master of the subject. It was under his direction that the collection of building stones at the Jermyn Street museum was brought to its present state of efficiency. He is also known for his services in connection with building stones and mortar on the international committee for the testing of materials.

The book deals chiefly with geology, but also describes the various stones from the points of view of durability and strength. It thus forms a useful link between geology and architecture and civil engineering. Most of the examples are taken from the British Isles, the occurrences in which are dealt with in full detail; and wherever characteristic types are found in other countries these are described shortly. The first chapters enumerate the principal minerals entering into the constitution of rocks. Then come chapters on granite and other igneous rocks. These are followed by descriptions of sandstones and grits, then of limestones and slates. There are chapters on weathering and testing. On account of the exigencies of space, ornamental stones are not discussed, nor is much attention given to stones used for road-making.

It is a pity that a book showing so intimate a knowledge of the subject should be disfigured by numerous inaccuracies in place-names. These errors may be debited partly to the copiers of the records and partly to the printer. The author and his collaborators cannot possibly know the name of every place sufficiently well to recognize errors of transcription or printing; we speak from experience. For instance, Penryn in Cornwall where granite is quarried is spelled Penrhyn which is the name of the slate quarry in North Wales. St. Neot in Cornwall is given an 's' at the end so confusing it with the town in Huntingdon. Elterwater appears as Ellerwater, Axe Edge as Axle Edge. Magnetite is spelt magnitite, and the mineralogical name of asbestos is given as chrysolite instead of chrysotile. It would be well to carefully revise the spelling of the place-names in a future edition, which will undoubtedly be called for soon owing to the general excellence of the book. E. W.

THE MINING MANUAL, 1911.—By Walter R. Skinner. Cloth, 8vo. 1500 pp. London: W. R. Skinner. Price 15s. For sale by *The Mining Magazine*.

This well-known year-book has been the dependable guide to English mining companies for 25 years. For the benefit of those who are new to the finance of mining we may say that it gives full information relating to every mining company registered in the United Kingdom; the nature of the business, the metals produced, the locality of the mine, the names and addresses of directors, secretaries, and engineers, capitalization, dividends, and a short resume of the history of each company. It has always been a wonder to us that so much detailed information can be published with so few errors. Some mistake or other is bound to be found. This year we notice that the renumbering of Bishopsgate Street Within and Bishopsgate Street Without, and the amalgamation of the two under the name of Bishopsgate, has escaped the notice

of Mr. Skinner. In the last year's book the address of the companies under the wing of Lewis & Marks was given as 28 to 31 Bishopsgate Street Within, instead of 34 Bishopsgate. The streets of London are a maze to inhabitants as well as visitors, but the associations are so strong that an obvious simplification is resented. Can this be the reason that Mr. Skinner has not adopted the new arrangement? It cannot be because he does not know of it.

PRACTICAL GUIDE TO IRON AND STEEL WORK ANALYSIS.—By Walter Macfarlane. Cloth, small 8vo. 190 pp., with illustrations. London: Longmans, Green & Co. Price 4s. For sale by *The Mining Magazine*.

This book is a condensation of the author's work entitled 'Laboratory Notes on Iron and Steel Analysis,' and has been prepared for those who aspire to be chemists in iron and steel works, but do not wish to go through the whole course of analytical chemistry.

THREE PHASE TRANSITION.—By Walter Macfarlane. Cloth 8vo, 190 pp., with many illustrations. London: Crosby Lockwood & Son. Price 7s. 6d. For sale by *The Mining Magazine*.

The production, transmission, and use of electricity are gradually coming within the range of subjects to be studied seriously by the mining engineer. The present book will be helpful to the engineer who desires to use current transmitted great distances at high voltages by the three-phase system, for it treats the subject from the commercial standpoint. The reader is of course supposed to have some knowledge of electrical engineering, but theory and mathematics are omitted, such algebraic expressions as are introduced being quite elementary.

THE RUSSIAN OILFIELDS AND PETROLEUM INDUSTRY.—By John Mitzakis, with an Introduction by J. D. Henry. Cloth octavo, 106 pages, with maps and illustrations. London: The Pall Mall Press. Price 3s. 6d. For sale by *The Mining Magazine*.

This book has been written for the benefit of investors and directors of companies working oil properties in Russia. It describes the various oilfields and gives details of the companies working these; also the methods of prospecting and development. The special value of the book is not so much the technology of the subject as the details of the Russian laws controlling the oil industry.

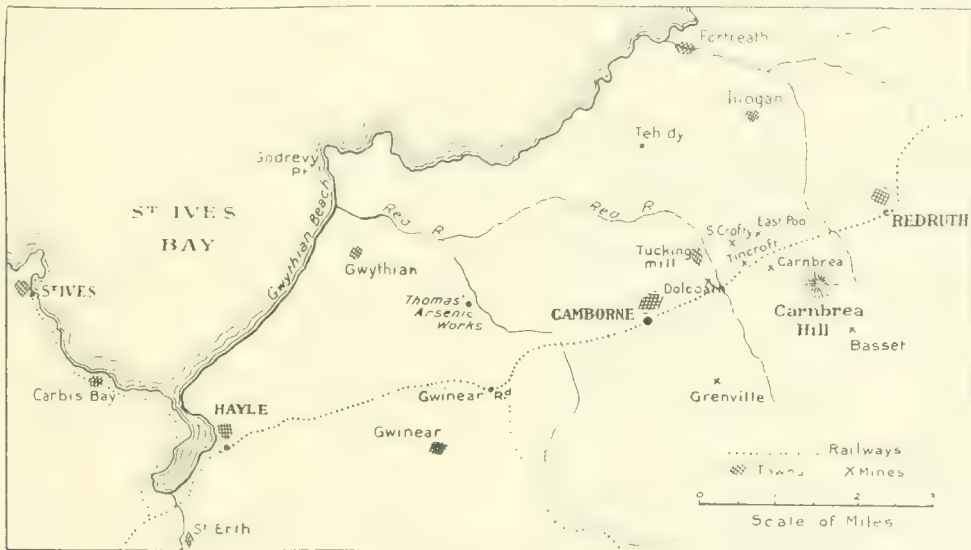
REPORT OF THE TRANSVAAL GEOLOGICAL SURVEY FOR 1909. Paper covers, quarto. 120 pages, with many maps and illustrations. Pretoria: The Government Printing and Stationery Office.

The districts studied by the Transvaal Geological Survey during 1909 comprised part of the tin districts of the Waterberg, the Marico district in the extreme west, the district to the northwest of Lydenburg, the Klip River valley between Johannesburg and Vereeniging, and part of the country round Pietersburg. In the present report, H. Kynaston, the director of the survey, describes the geology of part of the Waterberg district west and northwest of Warmbaths, and E. T. Mellor part of the same district north of Nylstroom. A. L. Hall reports on the district west and northwest of Lydenburg, and W. A. Humphrey on that part of the Marico district south of the Dwarsberg and on the valley of the Klip River. Owing to the importance of the tin production in the Waterberg district these monographs are of special interest at the present time.

COMPANY REPORTS

Grenville United.—This company was formed under the limited liability law in July 1906 to acquire the Grenville tin mine adjoining Camborne on the south, that had previously been worked for many years under the cost-book system. Peter Watson is the chairman and Henry Battens has recently been appointed manager. The ore is fairly clean, containing little wolfram or pyrite, so that the concentrate brings a good average price. The mining and metallurgical equipment is of the old Cornish type. The report for the half-year ended December 31 shows that 21,047 tons of ore was raised and 298 tons of concentrate sold, being an extraction of 32½ lb. per ton. The price received was £29,485 or £99 per ton, a figure, when compared with that of Carn Brea & Tincroft, that shows the high quality of the concentrate. The balance of profit,

an extraction of 27½ lb. per ton, is less than the average during the previous three years. The average price obtained was £82, the highest price since 1907; the total amount received was £38,930 and the receipts per ton of ore 20s. In addition £2202 was received from the sale of copper, arsenic, and wolfram concentrates. The working cost was £40,689, to which is added £1507 for lords' royalties, the net result for the half-year's work being a profit of £13. In recording the progress of this company six months ago we described at considerable length the old method of mining and concentration, and quoted R. Arthur Thomas' report on the subject together with his recommendations. We recorded that Viscount Clifden, one of the lords, had undertaken to provide a magnetic separator for the better treatment of the ore found at North Tincroft. This plant is now in place and should be at work by the time this notice is published.



FROM ST. IVES TO REDRUTH.

after paying £1077 as lords' royalty, was £4308. The half-year began with a debit balance of £10,465 and ends with one of £6157. During the period under review the heavy rain has caused serious flooding in the lower levels, and it has not been possible to gain access to the best ore. The water level is however being lowered again. Mr. Battens is strengthening the pumps with the object of combating the water in a more efficient manner. He also reports that he has inaugurated a better method of sampling so that less low grade ore and waste is being mined. He is making a general overhaul of the dressing plant, and extending it for the more complete treatment of the slime. But perhaps the most important improvement introduced by him is the purchase of supplies in the open market. He is now advertising the requirements of the mine and asking for tenders. In this way he should be able to reduce costs substantially.

Carn Brea & Tincroft.—The report of this Cornish tin mining company for the half-year ended December 31 shows that the receipts and expenditure have practically balanced. This compares with losses of several thousand pounds during the last two or three years. The amount of ore raised was 38,892 tons and 473 tons of tin concentrate was produced. This was

The other lord, Mr. Basset, has undertaken to contribute to the cost of certain development work a sum equal to his royalties during two years. The managers give details of underground developments, but have no important discoveries to announce. The capital funds of the company are running low, but it is hoped by reason of the present high price of tin and of the improved dressing methods, to accumulate a working surplus during the current year, so that it may not be necessary after all to reconstruct.

Dolcoath.—The report of the premier Cornish tin mine for the second half of 1910 shows that 44,659 tons of ore was raised and treated yielding 878 tons of concentrate which sold for £85,819. The yield per ton was 44 lb., and the average price received per ton of concentrate was £97. 15s. or 38s. 5d. per ton of ore. The amount of ore treated was 2620 tons less than in the previous half-year, the reason being that 60 of the old stamps have been dismantled. It is expected that 8 of the 12 new Holman air-cushion stamps will start work this month. The decrease in ore treated was more than compensated by a rise of 3.63 lb. per ton in the extraction and by the increase of £9. 1s. in the average price obtained. The total receipts for the half-year were £87,043, the working costs £56,807,

price of tin makes the present situation most satisfactory. The new main shaft has been sunk to 3000 ft., the present intended depth, and the pump stations have been finished. A cross-cut has been driven southward to cut the main lode, and the equipment

expected that everything will be ready by the middle of May. An analysis of the accounts shows that the cost of working was 25s. 5d. per ton, or 28s. per ton including lord's royalties.

Mount Morgan.—The report of this company, operating the famous gold-copper mine, near Rockhampton, Queensland, covers the half-year ended November 30. Several changes in metallurgical treatment have recently been made. In the first place, the oxidized ore being now exhausted, this part of the extraction plant has been closed. Second, basic ore is being brought from the Many Peaks mine for use as flux in place of the ironstone hitherto employed. This sulphide ore has a small copper and gold content, and its use will make it possible to treat larger quantities of ore; consequently the converter plant has been extended and the blast-furnace outfit improved. Third, the blister copper is now being refined at Port Kembla instead of being exported to America. During the half-year under review, 88,976 tons of Mount Morgan copper ore and 18,048 tons of Many Peaks ore was smelted, and the production was equal to 3084 tons of fine copper and 46,955 oz. fine gold. The Mount Morgan ore assayed just over 3% copper and 10.5 dwt. gold, and the Many Peaks ore assayed 2.13% copper and 0.175 dwt. gold. In addition to the smelting operations, the chlorination plant treated 59,620 tons of silicious sulphide ore, and produced 25,922 oz. gold and 259 tons copper; and 579 oz. gold was recovered on the clean-up of the old plant used in treating the oxidized ore. The total revenue for the half-year was £484,754; the average price of the copper sold was £58. 10s 9d, the amount sold not being stated, but approximately 2800 tons. The profit was £76,304 which, added to the balance brought forward from the last account, made an available surplus of £138,032. Dividends absorbed £100,000, being at the rate of 10%, and £24,706 was written off for depreciation of plant. Practically no prospecting and development has been done during the year, but several winzes and drifts have been made for the purpose of carrying out the ventilation scheme. As previously reported in these columns, the mine has substantial reserves, sufficient to last for many years, and for this reason, and because labour was required for altering the smelting plant, the development work has been suspended for the time.

Goldfield Consolidated.—This mine in Nevada has won fame by its large output of rich ore. J. R. Finlay has been manager during the last year and has recently resigned. The report for the year ended October 31 has just been published. It shows that the production was 497,045 oz., worth \$10,273,934, from 266,867 tons of ore, or an average of \$38.50 per ton. The total working cost was \$2,926,242, or \$10.97 per ton, leaving a profit of \$7,347,692, or \$27.53 per ton. The development work amounted to 41,938 ft. and cost \$9.05 per ft. In other words one foot of development work was done for every 6½ tons mined. Estimates of reserve ore were made every three months, but were not dependable, because the veins are too irregular,

and cannot be easily exposed on several sides, or their content determined. The report states that the amount of ore now exposed is supposed to be equal to twice the last year's production, but no information is given as to the cost of the ore.

Collbran-Bostwick Development.—This company, registered in the United States, is developing the Kapsan concession in Korea. Messrs. Collbran and Bostwick are already well known for their work in connection with the Suan gold mine, as described in our issue of June last in our notice of the Seoul Mining Co. The report of the development company now published describes the operations at the Ko Djin Dong copper mine during 1910. This mine was worked by the Koreans above adit level. The deposit consists of lenses of copper sulphides in crystalline limestone which also contains some sulphides disseminated through it. In order to develop the deposit at depth, A. R. Weigall, the manager, has sunk a vertical shaft, the top of which is 127 ft. above adit. At a depth of 191 ft. this shaft reached the hanging wall. As far as has been proved the deposit contains large amounts of copper ore. The ore in the lenses and in the limestone consists of chalcopyrite, arsenopyrite, and pyrrhotite, and no secondary minerals such as native copper, bornite, or chalcocite are found. For this reason it is considered that the ore is primary and that therefore there is a good chance of the grade continuing in depth. The average copper content of the sulphides in the lenses is 18%, and of the limestone ore 5%.

Oroville Dredging.—A company of this name was formed in America in 1905 to consolidate a number of gold-dredging companies operating in California. As a large proportion of the shares were held in England, a new company was formed under English law, in June 1909 to acquire the shares of the American company and eventually to take over the direct management of the properties. The English company has now issued a report covering the period from its incorporation in June 1909 to September 30, 1910. This shows that the exchange of shares is not yet complete, as several American holders have not yet sent their consent, and consequently the American company is still continuing in existence and acting as owner and manager of the properties. Accompanying the report of the English company is the report of the American company for the year ended July 31, 1910. Shortly after the incorporation of the English company, the Pato gravel mine on the Nechi river, Colombia, was acquired and a subsidiary called the Pato Mines (Colombia) Ltd., formed with a capital of £100,000 to work it. The purchase price paid to the owners of the property was 25,001 shares, £11,000 cash, and 74,993 shares were allotted to the American company as purchase consideration. The working capital for the Pato mines was to be provided by the issue of debentures, but owing to the opposition of the owners of the Pato property, 8% income notes have been issued instead. The working capital is being provided out of the profits of the American company and the notes are to be redeemed by the allocation of 75% of the net profits of the Pato company every year. Up to December 31, the American company had advanced \$271,017 and probably the whole amount required will be about £100,000. It is estimated that the Pato property will before long be making £40,000 per year profit. During the time that the financing of the Pato mine is being done the Oroville company is paying no dividend. The report of the American Oroville company for the year ended July 31, shows that at the four properties, 5,661,612 cubic yards of gravel yielded gold worth \$561,569, with a net profit of \$275,452. The Oroville Explora-

tion was the largest and most profitable producer, the amount handled being 2,885,074 cu. yd., the production \$317,270, and the profit \$199,168. The extraction per cubic yard was 11 cents and the cost 4.09 cents. The Bear River property, as before, has been worked at a loss. The area left for the three profitable companies to work is sufficient for six years' operations. The Bear River ground is not included in this estimate, though W. P. Hammon, the manager, considers that the advances made in dredge design will make this tract profitable later on.

Danube Mining Concession.—This company has been formed, as an expansion of the Danube Syndicate, for the purpose of acquiring a number of mining concessions in Austria and Serbia, and to develop them by means of subsidiary companies. The properties include copper mines in the district of Zell-am-See in Pintschgau, and graphite deposits at Artstaeden on the Danube and at Bruck on the Muhr. In Serbia the company acquires prospecting concessions in the Lutter territory, adjoining the Danube in the neighbourhood of the Iron Gate, and in the Kopaonick district to the south near the Turkish border. The Lutter territory is near the Bor gold mine which is worked successfully by a French company. W. A. Carlyle and John F. Allan have reported on the Austrian copper properties and Arthur Hall on the graphite properties. W. J. Barnett is consulting engineer to the company and is also a director.

British South Africa.—The annual report of this company is always read with interest, for it is practically an official report on a great potential kingdom. The charter was granted in October 1889, and the name 'Rhodesia' was shortly afterwards officially recognized, as due tribute to the founder of the state. For many years the shareholders have had to be content with the glory accruing to the Empire, and have not only received no dividend, but have seen the capital value of their holdings seriously decrease. The report now issued covers, as far as finance is concerned, the year ended March 31, 1910, and the reports of the directors and of the various officials in Africa bring the information down to the end of 1910. The accounts show that in Southern Rhodesia, which is the only part that has been much developed so far, the revenue was £626,171, and the expenditure £553,041. In Northeastern and Northwestern Rhodesia the income was £100,637 and the expenditure £143,389. Other revenues from mines, land, and investments amounted to £226,307. On the other side of the accounts £233,762 is charged as administrative expenses, interest on debentures, etc. The net result for the year was a balance to credit of £22,923. The report shows that during the year 1910 the production of metals and minerals was as follows: gold £2,568,198, silver 217,633 oz., lead 745 tons, coal 180,068 tons, chrome iron ore 41,072 tons, copper 359 tons, asbestos 659 tons. The output of gold was less than that during 1909, which was worth £2,623,709, and the reason for the fall is given at considerable length by Sir William Milton, E. W. S. Montagu, P. S. Inskipp, and A. H. Ackermann. Put shortly, the explanation is that two years ago special facilities were given to encourage small producers. Owing to the success resulting, these small men were enabled to interest capitalists, who considered it the best policy to suspend operations while independent examinations were made and further developments taken in hand. No information is given about other metals. The report covers 80 pages, and is concerned chiefly with administration, and with descriptions of steps taken to encourage agriculture.

Arizona Copper.—This company with headquarters in Edinburgh owns the Longfellow and Metcalf groups of mines, together with smelters at Clifton, Arizona. Norman Carmichael is general manager. The report now issued covers the year ended September 30 last. During this period 788,986 tons of ore was raised, of which 454,513 tons came from the Humboldt and other mines of the Longfellow group and 334,473 tons from the Metcalf, Coronado, and other mines of the Metcalf group. The amount sent for treatment was 754,187 tons, of which 96% went to the concentration plant, and 4% direct to the smelter; 85% was sulphide ore and 15% oxidized ore. The production was equivalent to 14,739 long tons of fine copper, a yield of 2.15% per ton of ore treated. The average ratio of concentration of the sulphide ore was 5.14 to 1.



Coronado Mountain and Metcalf

The oxide concentrator treated 115,223 tons and produced 12,392 tons of smelting concentrate, the tailing being subsequently leached with sulphuric acid. The sulphide concentration plant is being reorganized and extended, so as to make it possible to treat lower grade ore, of which there are great reserves. A new shaft has been sunk further up the hill, and the ore in future will be delivered above the concentrators, so saving much handling of material. As it has become obvious that the present blast-furnace plant is not up to date, the directors have decided to make full inquiry into the position, and they expect to have to recommend the expenditure of large sums of money on a new plant. The income from the sale of copper during the year was £832,290, and the income from investments in the railway, etc., £85,823. The profit was £254,471, out of which £22,143 has been allocated for income tax, £20,000 placed to reserve, and £4680 paid as interest on debentures; the preference shares and preference stock receive £24,531, and the ordinary shares £189,987, being at the rate of 50%.

Sudan Goldfield

Work continued on the N. and S. veins. A new shaft was sunk to the level of the 10 stamp mill. The company was reconstructed in 1908 for the purpose of raising additional working capital. The veins are narrow and the content variable. The report now issued covers the year 1910 and shows that 14,662 tons of gold were produced, with 11,546 tons and £20,465 during the thirteen months from the reconstruction of the company to December 31, 1909. The cost, including allowance for depreciation, was £31,121 leaving an adverse balance of £6227. A year ago the adverse balance was £14,245. The results of development during the year have not been quite satisfactory, as the veins are found to be poorer in the deeper levels, and the reserve on December 31 was only 6010 tons. The company has £7648 cash and gold in hand, and there is uncalled capital amounting to £6397 being 1s. per share. The company is pressing forward development work in depth in the hope that the veins will improve in value.

Geevor Tin Mines.—This company has been formed for the purpose of continuing the development work done by the North Levant and Geevor, Limited. The latter company was floated in 1906 by the West Australian Goldfields, and the reorganization is being carried out by the West Australian Goldfields Assets Co. Oliver Wetherell is chairman, and R. Gilman Brown is on the board. The mine is situated on the west coast of Cornwall in the neighbourhood of the Levant and Botallack mines. A feature in favour of the enterprise is that the lodes have not been worked by previous owners to any great depth. Much development work has been done during the last three years, and recently a new shaft was started. The sinking of this shaft is being conducted concurrently from two points, one part from the surface, and the other from the deep adit. The surface plant consists of two Holman air-cushion stamps, Wilfleys, and vanners; plant for treating slime is to be erected. Altogether £24,000 has been spent. The capital of the new company is £50,000, in 10s. shares, of which 64,500 will be allotted to the shareholders in the old company, and 34,893 shares are now being offered for subscription; 20,893 have been underwritten. At several points excellent bodies of tin ore have been found, and with the extra money for the completion of the shaft and the advantages thereby gained, the company should have a promising future. R. Arthur Thomas has recently made an examination and reports hopefully.

TRADE NOTES

Most of the trade publications mentioned in this column are available for distribution and the manager of "The Mining Magazine" will be pleased to secure copies for persons interested.

The British Aluminium Co. have issued a number of pamphlets explaining the various uses and the electrical and mechanical properties of this metal.

The British Humboldt Engineering Co. announce that they have presented a half-size working model of a Wetherill Crossbelt Magnetic Separator to the Bessemer Laboratory of the Royal School of Mines.

John Harrison & Co. make a speciality of iron

and wood portable buildings, which are described in illustrated catalogues. Isolation hospitals are described in a separate publication.

Lap-Welded Pipe made of spiral steel, is now being made in sizes from 12" to 72" in diameter by the American Spiral Pipe Works of Chicago. The pipe is calculated to withstand a strain of 60,000 lbs. per square inch.

Boiler and Engine Fittings are described in the new catalogue of Dewrance & Co., London. The colour work in the illustrations is particularly advantageous in clearly identifying the parts made from bronze, iron, or steel.

The Paterson Hydraulic Agitator is described in Bulletin No. 61, issued by the Wilfley Mining Machinery Co., Ltd. The technical details and advantages are fully explained by text and illustrated by careful drawings.

The Merton Furnace Company announce that they have received an order for a Merton furnace from the English Crown Spelter Co., Ltd. This is the third Merton furnace to be installed at these works, the first furnace was erected six years ago.

The Allis Chalmers Co., London office, report the sale of two McDougal furnaces and a fine-roll crushing plant for England, and an all-slime cyanide plant for Africa. This last order was notable because of the short time allowed for delivering.

The number of important parts required to make up a complete working unit are not always appreciated by the users of machinery. The Bulletins issued by the Oil Well Supply Co. illustrate how much thought and skill is required to make up one efficient drilling machine.

Messrs. Werf Conrad are mailing a brief summary of the results obtained from their dredges operating on the Tongkah Harbour, Siam, and the Renong property on the West Coast of the Malay Peninsula. The dredges in both properties are working alluvial tin deposits.

The Ingersoll-Rand Co. have purchased a controlling interest in the A. S. Cameron Steam Pump Works. These two strong American companies have had the confidence of the users of pumping machinery and compressed air in its many applications for many years. The combined interests should develop a much larger business for both companies.

The British Niclausse Boiler Co. have issued catalogue No. 1 to describe their water-tube boiler, and claim in addition to generally superior working efficiency, small cost of transport, light weight, absence of special bricks, simplicity of erection obviating the necessity of a special workman. These advantages will appeal to mining companies operating in inaccessible localities.

Worthington Pump Company.—General catalogue No. 10 describes with excellent illustrations the large variety of pumps of their manufacture, from small units per boiler feed, to Triple-Expansion High-Duty Pumping Engines. Twenty of these pumping engines of about 300 hp. each are used in the Coolgardie Water Supply scheme. The catalogue contains useful tables on pumping duty.

Adolph Bleichert & Co. have issued two new bulletins describing wire ropeways and telfers. The telfer is a suspended tramway for use in transporting machinery supplies and crude material, etc., in and about works, and is recommended to displace hand carts and surface trams. It has the advantage of not requiring ground space. The motive power is produced from an electric motor attached to each bucket.

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Scientia non habet inimicum nisi ignorantem.

T. A. RICKARD, Editor.

EDGAR RICKARD, Business Manager.

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REVIEW OF MINING

INTERNATIONAL MARK.—In the middle of March the mining market, especially that in Kathies, suffered from Paris legislation, several *agents de change* having been hammered. Reports were also current of financial troubles in other quarters, causing acute depression in some of the leading Rand states, as well as Tanganyika, Senenya, and Grant. The mid-March Stock Exchange account showed the extent of the depression, among the few shares that had risen being Golden Horse-Shoe, Mysore, Lena, Taquah, and Abosso. Subsequently a general recovery ensued, and by the end of the month the mining market was in a strong position. The anxiety caused by trouble at Paris had been removed and no basic weakness had been disclosed. Money is cheap and promises to be even more plentiful. The accumulation of capital that was interrupted by the Boer war, the San Francisco disaster, and other events of worldwide importance, has been proceeding steadily for several years and promises to create conditions highly favourable to speculation. The brilliant success of the Brazilian 4% and Indian 3½% loans, as well as other recent issues, indicates that money is readily available for profitable use. An era of expansive activity in mining and other reasonably speculative forms of adventure appears to be impending.

TRANSVAAL.—The average working cost on the Rand during February was 4 pence higher per ton than in January, and 9 pence more than in February last year. On the other hand the yield was 1 pence higher than in January. This suggests the operation of the idea underlying the square fathom, namely, avoiding breaking of ore that will not yield a profit.

"'Tis an ill wind turns none to good." The fuss caused by Lord Gladstone's action in a recent case in Rhodesia has done service to the

mines by prejudicing the colonists against the employment of natives in domestic service. Should this tendency be confirmed, it would release many 'boys' for labour in the mines. In the annual report of the Transvaal Chamber of Mines it is stated that the native labour comes from different parts of Africa, as follows: Portuguese East Africa, 51.9%; Cape Colony, 26.02%; Transvaal, 7.49%; Natal and Zululand, 6.67%; Orange Free State and Basutoland, 3.57%; and other districts, 4.29%. The general tendency is for an increased recruiting in the British provinces, notably Cape Colony and Natal. The Cape 'boys' are poor workers, therefore a small increase in mere numbers, such as the gain of 2500 in the total labour supply for March, means nothing. Since April last year the gain is only 5600, which is a nominal improvement, many of the efficient workers having been replaced by green hands.

Sir Joseph Robinson sent a strongly worded telegram denying the rumour that more money would have to be raised for the Randfontein group. The bitterness underlying his protest is due to a feud of long standing. The reference in the telegram was to Barnato Bros. It is also no secret that Sir Joseph's dearest wish is to find a rich diamond mine in South Africa so as to offer effective competition to the De Beers company, for the controllers of which he has no liking, and never had.

The annual report of the Crown Mines is a fine record in gold mining. During the year 1,514,000 tons were milled for a yield of 33s. 9d. per ton, at a cost of 18s. 2d., and a profit of 15s. 7d. per ton, yielding £1,182,224. The total profit was £1,214,178. Capital expenditure amounted to £426,452 and advance development to £83,111. Inadequacy of labour supply is stated to explain the diminished tonnage and increased cost last year. The ore

reserve is estimated at 7,300,000 tons, containing 7'6 dwt. per ton. Better results are promised.

The annual report of the General Mining & Finance Corporation, like that of the Consolidated Gold Fields, reflects the lessened opportunities lately afforded to finance companies operating in the Transvaal while at the same time it confirms the strong position of the better class of mining ventures on the Rand. In 1909 General Mining made extraordinary profits, so big as to belittle the results for 1910, yet the past year was far ahead of 1908 and on the whole makes an excellent showing. A conservative policy is followed in declaring only a 7½% dividend, while carrying £269,277 forward.

Mining for metals other than gold in the Transvaal has not been important but we note that the Messina, a most promising copper enterprise, is able to report the cutting of a vein, assaying 36% copper for a width of two feet. This ore contains chalcocite and has been found at a depth of 708 feet.

The successful employment of electricity, instead of steam, at the new plants of the City Deep and Village Main Reef is an important event and is highly creditable to the Central Electric Supply Co. The economic benefit is variously estimated at from 6d. to 1s. per ton of ore crushed.

RHODESIA.—The statistics for February, as published by the Chamber of Mines, show a decrease of 1651 oz. gold as compared with January, but an output almost exactly equal to that of the same month last year. Making allowance for the shortness of the month, the decrease is not significant. As usual it can be explained by the variation in the Globe & Phoenix output, which was £36,858 as against £41,664 in January. The Giant also decreased from £18,752 to £17,461, and the Eldorado from £18,390 to 17,159, but the Jumbo output improved from £5555 to £6254 and the Wanderer from £7031 to £9082.

Giant shares suffered from an attack of geology. When a specialist like Mr. Corstorphine is engaged to advise upon exploratory work, it suggests that the condition of the mine is serious. In order to "re-locate the reef," that is, to find the continuation of the orebody, it has been decided to use the diamond-drill freely. This is sensible, but it also indicates that the continuity of the ore is obscured by unknown factors.

The Shamva mill-tests tend to confirm the previous sampling of the deposit, the four trials yielding slightly more than the average obtained after making allowance for erratic high assays. This is creditable to the engineers of the Consolidated Gold Fields. Good news has been received from the Farvic and Lonely mines, but it is not as conclusive as interested parties represent.

The Globe & Phoenix has issued a monthly report in which it is stated that "in cases where the width is below 30 inches the values are reduced so as to show the average value over a stoping width of 30 inches." The idea is excellent, for shareholders learning of 10 inches of 5 oz. ore do not realize that when stoped this ore cannot be broken clean for so narrow a width, but is mixed with about twice as much adjoining vein-matter, which may contain enough gold to be worth mining.

Tanganyika shares have been weak, as was natural, but the market is technically strong owing to the fact that it is over-sold. A large bear account exists. Meanwhile the Press is publishing letters of an unconvincing nature, from which one fact emerges, namely, that the publication of Mr. R. J. Frecheville's report, even though unfavourable, would have hurt the undertaking less than the knowledge that the report, made for the Consolidated Mines Selection Co., was offered for £4000 to the Tanganyika people and declined on those terms, so that the opinion of a first-rate engineer was effectually suppressed.

The finding of a large body of "auriferous

banded ironstone" is announced to have been made close to the railway in Rhodesia, at Hunter's Road siding. The ore is said to show a continuous outcrop for nearly two miles and to be from 15 to 17 feet wide. Three prospecting shafts down to 85 feet, and several trenches, have exposed ore assaying about 8 dwt. gold per ton. Options on the entire property, covering 290 acres, have been secured jointly in equal shares by Wilmoughby's Consolidated Co., the Surprise Gold Mining Co., Chicago - Gaika Development Co. and the South African Option Syndicate.

WEST AFRICA.—Further good news comes from the Ashanti Goldfields, another of the cross-cuts through the foot-wall into the vein having cut six feet of ore showing gold freely. This is on the 6th level, and it is believed that the ore-shoot now partly uncovered at this level is a continuation of the lower-grade orebody previously found on the 3rd level. A dividend of 25% is announced. The Taquah developments are most encouraging, the 8th and 9th levels making a good showing, with favourable prospects on the 10th and 11th. At the Abosso the ore on the 9th and 10th levels averages better than during the previous month. These two adjacent mines give every promise of justifying expectations. The Broomassie is opening up well on the 770 and 990 ft. levels, some of the ore on the bottom level being distinctly high-grade. The mill resumed work in March and its capacity is to be increased to 3500 tons monthly.

AUSTRALIA.—At Kalgoorlie the sequelæ of the Bullfinch boom are still matters of current gossip, the general feeling being surprise at the good sense shown in London, seeing that local mining men of distinction allowed themselves to be carried away by the excitement due to the finding of a patch of abnormally rich ore. The Chaffinch affair is still *sub judice*, but the enquiry now pending ought to illumine some dark places. During the boom hundreds of leases that had not even

been passed by the Warden were made the basis of company promotions. The passage of the Bill for building a branch railway was strongly opposed, and before it was passed it was admitted that several members of the Government held shares in the Bullfinch Proprietary. Some of the natural inferences may have been unjustifiable, but the impropriety of the proceeding cannot be denied. Mr. Dorham Doolette is generally complimented on the manner in which he managed the boom. The adverse criticisms of Mr. Gerard Williams, to which we referred in our last issue, led to a personal altercation with Mr. C. Jones, the prospector, who resented the depreciatory comment of the correspondent for *The Times*. It is considered that the boom will cause a deserving goldfield to be more thoroughly prospected; among the prospects, the Corinthian, Mountain Queen, and Transvaal leases, are expected to give good results. The Meekatharra district is promising, but is not likely to develop individual mines able to supply more than 20 stamps apiece. The Ora Banda, about twenty miles north of Kalgoorlie, toward Broad Arrow, is regarded as more promising than the Bullfinch district. The Associated Northern has taken an option on the Gimlet South. A good deal of work has been done in this vicinity, disclosing big lodes, up to 60 feet wide, carrying about 10 dwt. ore. The sulphide zone has been reached, but not yet adequately tested. At Kalgoorlie itself the bad impression due to poor results in depth has not been removed by drill-core assays. The Associated mill has been overhauled, the main shaft has been re-skidded and sunk to 2200 feet. Boring and development have failed to find any important orebody but the mine generally is in good shape, and the mill is in condition to operate cheaply. The manager, Mr. George Roberts, has resigned; while essentially a metallurgist he has had a good deal of experience in mining and is well esteemed. His successor is yet to be appointed. The

Great Boulder drillings at 2800 feet are encouraging, but bore-holes are not dependable, and no one knows it better than Mr. Richard Hamilton, the veteran manager. The Perseverance is being operated efficiently and cheaply, the mine cost being 18s. per ton on an ore that yields 26s. per ton; this is splendid work. The Ivanhoe is regarded as the best mine on the Golden Mile.

Just at the time when the West Australian group was being heartened by Mr. Hamilton's borings in the Great Boulder and Mr. Sutherland's inferences at the Golden Horse-Shoe, and a little life was being imparted to the shares of the Kalgoorlie group, a bad bit of news comes from the Kalgurli mine. It says that "the stopes for the past three months have not maintained the usual grade of ore, and in consequence profits will be reduced in future." This comes on top of a successive monthly decrease in production and profit.

Our Melbourne correspondent refers to the three leading Broken Hill mines and their excellent performance. The North and South mines both have large and expanding reserves of ore, exceptionally uniform in contents, but as the South mine has large zinc-tailing dumps its income from zinc is greater than that of the North. The ore at the North averages 15·8% lead, 13·5% zinc, and 6·5 oz. silver, while that of the South averages 14·9, 12·5, and 5·9, respectively. At 1100 ft. in the North and at 1070 ft. in the South, the showing is most promising. The operating cost is 13s. at the North and 16s. at the South, yielding a profit of 11s. and 8s. 7d. respectively. This is splendid work, highly creditable to the managers, Mr. George Weir of the North and Mr. W. E. Wainwright of the South mine.

It is announced that the Broken Hill South Extended is to adopt the Murex process. At the same time the directors of the Murex company announce that Mr. W. J. Loring has joined the board and that Bewick, Moreing &

Co. have agreed to act as their managers in Australia.

The Mount Boppy continues to be the premier gold mine of New South Wales and appears to be in a healthy condition. On a production of £1,000,000 it has paid the shareholders £400,000, or more than three times the nominal capital. Geologically this mine is unique. Apparently the synclinal formation of ore is fed by a steeply pitching neck of quartz that may prove to be a persistent vein. Details would be of a great technical interest and we hope they will be published.

Some of the drawbacks to mining in the Australian desert are suggested by Mr. J. A. Agnew's reference to the trouble of keeping men at work on the boilers and roasting furnaces at the Lancefield mine when a vertical sun is blazing overhead. It became necessary to work in 4-hour shifts.

INDIA.—The most interesting feature of the month in connection with Indian mining has been the announcement that the cost of treatment has recently been reduced substantially on the Kolar goldfield and that in consequence large amounts of lower grade ore can now be included in the reserve and treated without decreasing the profit. For instance, at the Mysore mine it will be possible in future to mill 16 dwt. ore instead of 19 dwt. and still make sufficient profit to continue the 115% dividend, which has been paid for three consecutive years. The reduction in cost is due chiefly to the advantages gained in the more rapid and efficient hauling now rendered possible as a result of the recent policy of spending large sums of money on capacious shafts and improved winding plant. It is also due to the great decrease in the cost of power since electric current in bulk has been bought from the Cauvery Falls Power Co.

SIBERIA.—Lena Goldfields shares have been the sport of verbal inexactitudes at St. Petersburg, it having been reported there

that two more holes outside the range of existing workings had struck rich gravel and that a 2s. interim dividend was imminent. All this is entirely false. The approach of spring, and of the washing season, suffices to explain renewed interest in this important mining enterprise: otherwise, nothing new can truthfully be reported. We note also with amusement that some of the daily financial papers have assumed that actual washing had commenced, being misled by the statement regarding 739 oz. worth £2778 having been cleaned-up. They omitted to note that exactly the same figures have appeared in successive monthly reports, for they refer to the yield from a remnant of gravel left over from last season and now recorded because the custom of the company is to state the total gravel washed from the beginning of the financial year onward. Until regular washing operations are resumed that 739 oz. clean-up will be quoted without change. Up to February 22 the amount of gravel mined since October 1 was 378,977 cubic yards, which compares with 336,686 cu. yd. at the corresponding date last year. It is a pity that the estimated average content of this accumulated ore cannot be given, for lacking such information the yardage measures only the digging energies of the men employed. However, we appreciate the technical difficulties involved and refrain from pressing the point.

The Kyshtim monthly report is excellent. Mr. H. H. Knox, formerly consulting engineer to this corporation, has become advisory engineer in New York and London, while Mr. R. Gilman Brown, already a director, becomes consulting engineer.

CANADA. — We publish an authoritative article by Mr. W. J. Loring, giving the latest news concerning Porcupine. For the photographs we are indebted to Mr. W. E. H. Carter. Mr. David Richards, as a director of the Sons of Gwalia, is on the spot, representing a quarter interest in the Northern Ontario Exploration

Co. We may mention that shares in the latter are being acquired from some of those who took a flyer at the time of organization, leaving them with useful options on unissued shares.

Cobalt maintains its prominence as a silver-mining district, the output for 1910 being estimated at 33,500 tons, yielding 28,500,000 oz., worth \$14,500,000. This compares with 29,942 tons, 25,897,825 oz., and \$12,461,576 in 1909. The dividends last year totalled \$6,250,667, while those declared in 1910 but payable in 1911 amount to a further sum of \$1,705,730. The Nipissing has now returned \$6,340,000 and the La Rose \$3,284,007.

MEXICO. — At the end of the month a cablegram was received announcing an encouraging find in the Mexico of El Oro, a winze at a depth equal to the 9th level having intersected a sulphide vein 13 ft. wide and assaying about \$30 per ton. Work on the 8th level also is reported by Mr. Fergus Allan, the manager, as most satisfactory. We note with pleasure the appointment of Mr. André P. Griffiths as consulting engineer to this company.

Among the few unpleasant incidents affecting the English mining enterprises in Mexico is the imprisonment of Mr. Gillmore Goodland, managing director, for the Batopilas Mining, Smelting & Refining Co. He discharged an employee and thus became involved in a technical difficulty of which improper advantage was taken. On the other hand, we note that the accountant at the Tominil mine writes saying that the local authorities have restored telegraphic communication and that the only trouble is the interruption to the postal service. The mill is running and the Mexicans employed are getting used to the work. At present extraction is 82% but increasing. From the Avino mine the manager, Mr. R. H. Jeffrey, sends a cablegram stating that the position has been much improved and that he expects to recommence operations, previously stopped by a band of insurgents.

UNITED STATES.—On March 15 the Miami concentrator started to work and another of the new copper discoveries thereby becomes productive. This mine, at Globe in Arizona, has been developed under the direction of Mr. J. Parke Channing, to whom great credit is due. The owners are the Lewisohns, acting through the General Development Co. Within two years the production is expected to reach 15,000 to 20,000 tons annually of copper, to be put on the market at a cost of 9 cents per pound. The ore reserve is estimated at 40,000,000 tons of 27% ore. In March also the Ray Consolidated, in Arizona, began crushing ore with a view to making a marketable copper concentrate. This is another of the big disseminated copper mines, being credited with 80,000,000 tons of ore yielding 28 pounds of copper per ton, and expected to produce 35,000 to 40,000 tons of metal at a total cost of $8\frac{1}{2}$ to 9 cents per pound. A third menace to the copper market is the Inspiration mine, also at Globe in Arizona, controlled by Mr. William B. Thompson and associates. The ore reserve is given as 22,228,000 tons averaging 2%, and a mill with a capacity of 5000 tons daily is to be erected shortly. The cost of production is assumed at 9 to $9\frac{1}{2}$ cents per pound. So far \$552,076 has been spent in development. Another deposit of the same type, the Chino, in New Mexico, is being prepared for production. The ore assured is estimated at 45,000,000 tons, averaging 2.3% and is expected by those interested to yield 20,000 tons of copper annually at a cost of 9 cents per pound. But all these estimates of total cost are regarded, by those well informed, as being highly optimistic, save in the case of the Miami, where conservative figures are given. An average price of 10 cents per pound for this additional Arizona output will be nearer the mark.

Rumours have again been circulated in America to the effect that the directors of the Arizona Copper Company are negotiat-

ing for the sale of the mine to the Guggenheims. Two of their number are now in America with the object of ascertaining how much new capital expenditure will be required in order to make it possible to treat the great reserve of low-grade ore. The company has always found it difficult to manage an American copper mine from Edinburgh, for it is not easy to watch closely the mine and the market at so great a distance and to keep in touch with the constantly varying requirements of copper metallurgy. For this reason the directors might welcome a change in proprietorship provided suitable terms were presented, especially since the death of John Gill, the chairman, who had so large a holding in the company. It does not, however, necessarily follow that other proprietors would do any better than the present board. For instance, in 1910 a profit of a quarter of a million pounds was made from a production of 14,739 tons of copper, at an extraction of 2.15% and without gold and silver contents.

The Yukon Territory is likely again to become conspicuous financially by reason of a new venture based on gold-bearing gravel deposits in the Klondike district. A syndicate with a capital of £200,000 has been formed by Messrs. H. C. Hoover and A. C. Beatty, half of the amount being placed in New York and half in London. The intention is to bring out a company later with a view to exploiting a number of claims situated on Dominion, Quartz, Last Chance, Eldorado, and other famous creeks near Dawson. The vendor is Mr. A. N. C. Treadgold, well known in connection with the Yukon Gold Co., an enterprise controlled by the Guggenheims. The money now raised is, we understand, to be loaned to Mr. Treadgold, who, in return, gives the syndicate the call on his rights with a view to an issue when it is deemed expedient. The property has been examined by Mr. W. E. Thorne, who has submitted a favourable report.

EDITORIAL

ROYAL SCHOOL OF MINES men are reminded that the annual dinner will take place on May 4 at the Café Monico. Sir Thomas Holland will be in the chair. A good attendance is already assured.

SUBSCRIBERS receiving this issue of the Magazine by mail will convey a favour by reporting any injury to their copy. We are testing a new wrapper, in the hope of delivering the Magazine without the occasional injury incidental to the use of an envelope.

LACK of space prevents us from commenting at length on the prospectus of Westralia United Goldfields. This illustrates what such documents should not be. The reports are most unconvincing and are prepared by local men lacking the qualifications that appear to us as necessary. They are endorsed by the company's consulting engineer, a young metallurgist who has yet to win his spurs as an appraiser of mines. The predictions and promises of production and profit, up to £312,000 per annum, for the group of prospects forming the basis of the flotation are all highly sanguine, if not absurd.

AMONG the technical articles appearing in this issue is one by Mr. Allan J. Clark, who is metallurgist to the Homestake Mining Company, operating the celebrated mine in South Dakota. We commend this article to the younger members of the profession as a good example of careful and attractive writing. Another article on cyanidation appearing in a recent issue of the *Mining and Scientific Press*, and written by Mr. E. M. Hamilton, serves as a pleasant reminder that specialization in a highly technical subject does not atrophy the faculty for perspicuous

and graceful writing; on the contrary, a man who tries to do one thing conscientiously is apt to bring the same qualities to bear on every act of his life.

ANOTHER prospectus issued recently is interesting as referring to an abandoned copper mine in Cheshire. The reports are made by engineers well qualified for the work and we regret therefore that the information given is unsatisfactory. Twelve samples as a basis for an estimate of 5½ million tons of 2% copper ore is not convincing, however regular the deposit may be. Moreover, the workings appear to be in part under water and largely inaccessible. The information is sketchy and does not warrant the talk of ore-bodies valued at £7,350,000, from which a profit of £3,675,000 is anticipated. The references to reliable assayers and metallurgists do not mean much, because they are not responsible either for the sampling or the rash inferences therefrom. The Alderley venture is not based on adequate technical information.

CIRCULAR letters are being received in London from Mr. Albert Freeman, of New York, offering shares in a Porcupine property adjoining a property which is near another property in which an orebody of "several million dollars" has been developed "at an expense of less than \$150,000." Thus the Britisher has a chance of being neighbour to the very people who are making real money in mining at Porcupine. Mr. Freeman announces himself as an associate of Mr. Julian Hawthorne—an introduction marked by cheerful insouciance—but it is hardly likely to be treated as an adequate endorsement. We confess that if our friends in London desire aid in the use of money for

speculation in mining, they might get more reliable guidance than that of Mr. Freeman, of Mr. Hawthorne, of Mr. Gaylord Wilshire, or Mr. Thomas W. Lawson. In any event we may state as a profound observation that people who expect to get into a "several" million dollar mine on the invitation of circular letters are usually disappointed.

UNDER 'Discussion' we publish an interesting letter from a financier not without authority. His way of looking at mining speculation will commend itself to many of our readers. In any event we are glad to afford publicity to views coming from one who has proved that mining promotion can be as honourable as any other form of business. Owing to the receipt of his letter just as we were closing for the press, we are unable to make lengthy comment, but in our next issue we hope to do so. In May also we shall publish the first of a series of articles on the finance of a mine, by Mr. M. H. Burnham, a mining engineer of wide experience. These articles will, we believe, present new aspects of a vital subject.

WE note several plaintive letters in *The Financial Times* from correspondents whose shares have declined in value, especially Kaffirs, Rhodesians, and West Africans. They want to know why prices have declined, and they complain bitterly that in some cases the quotations are withering in the face of real progress at the mines. They call upon the "big houses" and the "professional operators" to give the market a boost and offer a little encouragement to the public. What for? Obviously to raise prices so that they, the complainants, may get out without a loss. It is pathetic, and it is an old story. Those who bought shares at inflated prices in the fond expectation of finding someone even more reckless on whom to unload have found that they are "holding the baby." Meanwhile the well in-

formed gentlemen on the inside, having made excellent use of the blatant optimism of a credulous public, are sitting back with a sardonic smile, having realized enough of their holdings to be "on velvet." This is what *The Financial Times* might have told the poor fellows who signed themselves "Anxious" and "Monte Cristo." Probably they were more anxious than Monte Cristo.

THE ANNUAL general meeting of the Institution of Mining and Metallurgy was an interesting function. The Secretary's report reflects the continued expansion and growing influence of this professional organization. From a membership of 730 in 1901 the Institution has grown to 2056 in the last decade. By its services in connection with the Royal School of Mines and also the new Club, the Institution as a society has exhibited a breadth of public spirit and vigorous initiative highly creditable to all concerned. Incidentally, we note with pleasure that the meetings are likely to be held in future at Burlington House, in the room loaned by the Geological Society, as was the case before the recent unfortunate migration to Westminster. An announcement to this effect was received with general applause. On retiring from the Chair, Mr. Edgar Taylor made some appropriate remarks, dealing mainly with the award of medals to Sir Julius Wernher and Mr. L. D. Ricketts. As usual he made no long speech, for it has been one of his qualifications as President that he has never said too much and everything that he has said has been both sensible and dignified. A charming appreciation of his services was expressed in a speech of singular appropriateness by Mr. R. T. Bayliss. We consider that he summarized the position admirably in saying that while two years ago the Institution was to have been congratulated on having as President a member of the distinguished firm of John Taylor & Sons, it would be unanimously agreed to-day that the firm could be congratulated on the

distinction which Mr. Taylor, "by reason of his conduct in the Chair," had added to its name. It remains to congratulate both the firm and that member of it who has performed a public function so successfully. The valedictory address to the retiring president was followed by the induction of his successor in the office. Mr. H. Livingstone Sulman made a modest reference to his misgivings in following one who had set so high a standard of service and acknowledged the goodwill of the members generally. Then he delivered his address, a highly technical and extremely interesting review of recent metallurgical research, especially as regards zinc. The paper is undoubtedly a notable contribution to technical literature and attains a level rare in presidential utterances. His references to the militant metallurgy of the oil processes was marked by good feeling and augured the possession of a degree of tact that should prove of the greatest value to the occupant of the Chair. We make references elsewhere to the technical subjects discussed by Mr. Sulman and it remains but to say that with a cordial vote of thanks the meeting closed, leaving a delightful impression of harmony and efficiency.

MEXICAN affairs are undergoing change for the better. Engineers writing to us complain that professional work has been interrupted by the insurrection, especially in the North, where the railways have been attacked. Several managers of mines report that postal communication has been severed and that it is difficult to obtain supplies, but not many mining establishments have actually been attacked. Our correspondent at Mexico City sends some interesting data. Speaking generally it is not so much the despotism of Diaz as the corrupt administration of local governors that has provoked resentment, especially in Chihuahua, where Señor Enrique C. (Henry Clay) Creel, by birth half an American, is regarded as the tool of General Luis Terrazas,

a big landed proprietor. To "save his face" the President has asked his cabinet to resign with a view to re-organization. Señor José Y Limantour, a man of recognized ability, is now Minister of Finance, and apparently the right arm of the discredited government. Reforms in the election laws and the judiciary are promised. General Diaz has introduced, it is said, a Bill rendering it illegal for a President to succeed himself—an amusing sequel to his continuous tenure of that office. More important is the news that Señor Limantour has had an interview, on American soil, with General Madero, the leader of the *insurrectos*, with a view to ascertaining what just grounds of complaint may exist. Evidently a spirit of compromise is in the air, stimulated without doubt by the threat of American intervention.

S. F. Emmons.

The grim Reaper has lately harvested the lives of many for whom we greatly cared. On March 28, a day before his 70th birthday, Samuel Franklin Emmons ended a gallant struggle with persistent illness and closed a career rich in fulfilment. It is true that during the last five years his physical disability had prevented any accomplishment equal to earlier efforts, but his achievement had been crowned before his vigour was abated. In 1907 his report on 'The Downtown District of Leadville, Colorado,' set the seal on his historic monograph on Leadville, issued by the United States Geological Survey in 1886. His first report, the precursor of the monograph, appeared in 1882. The twenty-five years intervening cover an epoch in the study of ore deposits and to that study Emmons brought an ability, an energy, and a sincerity worthy of a great leader in science. While still a young man, after completing a wide circuit of mineral exploration in association with Clarence King and J. D. Whitney, he undertook to decipher the complicated geological structure of Leadville, then the foremost silver-lead mining dis-

trict in the world. What Lyell did for the principles of geology, Emmons did for economic geology. To others it has been permitted to promulgate suggestive theories and to inspire intelligent investigation; this he did in full measure; but no geologist has so literally given the miner a lamp to lighten his way and a chart to guide his search. The maps of the complicated fault-system that dislocates the ore measures of Leadville have been tested by a generation of mine managers only to be the more trusted; his clear explanation of rock structure in a complex section of the earth's crust has been a lesson to students for more than a generation. Expressed even in a sordid unit it can be said that the Leadville monograph led to the discovery of orebodies valued in millions of dollars and gave intelligent direction to mining operations involving an incalculable amount of capital. If geology has failed at times in giving the miner the unequivocal utterance for which he asks, she did at Leadville, by the mouth of Emmons, afford advice so valuable as to redress all other failures. His views regarding the formation of ore, as illustrated by the chief mining districts of the Rocky Mountain region, aroused criticisms, of course, but he did not hurry to refute them. In 1893 Franz Posepny, in a notable contribution to the American Institute, raised objections based largely on misconceptions of earlier critics of the Leadville deductions; but Emmons deferred his reply, knowing that the supplementary investigation then in progress would give further data. In a land of hustle and in an age of hurry, this was a fine example of the patience that awaits the accumulation of the necessary facts. It was worthy of a disciple of Darwin. Not many will wait 20 years to refute their critics, nor is it given to many at the end of such a period still to hold the attention of their audience. Fortunately, while most men outlive most mines, the Leadville district has continued productive long enough to afford illus-

tration and incitement to the sons of the men who first crossed the Mosquito range and broke the silence of California gulch. In the interval the number of those to whom the application of geology to mining was a subject of vital interest has grown enormously. The economic geologist is no longer a voice crying in the wilderness, he is the counsellor and friend of the mining population. This is due largely to the writings of Emmons, whose papers, especially 'Structural Relations of Ore Deposits,' 'On the Origin of Fissure Veins,' and 'The Secondary Enrichment of Ore Deposits,' have been a help to every mining region where English is read. Even the few engaged in mining who are unaware of a direct debt to him are yet under obligation through the writings of those who derived their ideas from Emmons. Happily the knowledge, continental in its scope, of a thorough student of nature, was joined to a rare faculty for writing clearly, and to an instinct for truth that has penetrated many of the dark places of scientific thought. By birth at Boston he was an American; by education at Harvard he was a scholar; by friendship with Clarence King he was an enthusiastic geologist; and by nature he was a gentleman.

Waihi.

On March 21 the financial papers contained an advertisement of the New Zealand shareholders in the Waihi, asking British shareholders to join them in obtaining "a complete change of management" and the election of two barristers as directors. A Reuter telegram stated that the Colonial shareholders were much "agitated" by the recent revelations concerning the condition of the mine and that numerous local meetings had condemned the management. All of this may be taken with a liberal dose of salt. We question whether the shareholders in New Zealand were so surprised; on the contrary, we believe that they had reason to be much less surprised than their

of the prospects in England. We would like to know more about those local meetings before accepting them as spontaneous expressions of opinion. We demur entirely to the idea of electing barristers as directors of a mining company, unless the business of it be mainly litigious. On the other hand, we hold that the Waihi directors have exhibited lack of ability both in their recent policy and in the general management, which has been known among professional men to have been marked by lack of capacity and economy. Thus we shall be unpopular with both sides. We repeat that what the Waihi needs is skilful technical advice, the best obtainable for the money, on the difficult question underlying the impoverishment of the lode. The only doctor required by the patient is a specialist in a disease unfortunately not uncommon, namely, non-persistence of rich ore. Barristers will not help nor even eminent mine managers from Queensland. The directors should face the facts frankly or resign to men more capable of meeting difficulties of exceptional gravity. The Waihi needs the advice of an experienced mining geologist first and then someone able to re-organize their pumping equipment, with a view to deeper exploration. It is ten thousand pities that so fine a mining enterprise should have been brought to such a state of collapse, but a large reserve of ore remains and long before it is exhausted the prospects of the mine should be thoroughly diagnosed.

Globe & Phoenix.

The fifteenth annual report of the directors states that the reserve of ore in the Globe & Phoenix mine amounts to 178,221 tons, averaging 33·9 dwt. per ton and having a gross value of £1,268,950. This shows an increase, during the last six months, of 3433 tons and £84,853. The figures are encouraging, but they do not convey facts accurately. Some shareholders are likely to assume that £1,268,950 is available for dividends. Again we submit that the

directors should state clearly what amount of ultimate profit is likely to be won from the tonnage and gross value of ore in the mine. On turning to the general manager's report we note that the recovery during the year from an average of 54 dwt. ore was 43 dwt., so that the extraction was not quite 80%. Again we find that the working cost from October to December, inclusive, was £1. 15s. per ton. This is stated to be abnormal. Since then the cost at the mine has been reduced to 30s. per ton. But this does not include expenditure in London. On applying these deductions to the gross value of the ore in reserve, that is, taking 80% of the assay-value and allowing a total cost, at the mine and in London, of £1. 15s. per ton, we find that the £1,268,950 shrinks to £683,274. This is the amount of money likely to be available for dividends from the exploitation of the 178,221 tons of 33·9 dwt. ore. Obviously, stated in this way the resources of the mine look quite different. We do not desire in the least to depreciate them; on the contrary, we hope that they may be increased with cheerful rapidity. The point we wish to make is that it is misleading to state the value of an ore reserve in terms of assay-value. It is quite likely that the extraction on 33 dwt. ore will be better than it was on the 54 dwt. stuff, for high-grade ore usually yields a relatively richer tailing; but as it is known that some of the Globe & Phoenix ore is decidedly refractory, we cannot assume that the average extraction on all the ore included in the reserve will be better than 80%. As regards the total cost, that is not stated. In 1909 the cost at the mine was 28s. and in 1908 it was 26s. per ton. In 1909 the net profit was £150,646 on a yield of £280,733 from 74,492 tons of ore, so that the total cost was £130,087, equivalent to 35s. per ton, or 7s. per ton more than the cost at the mine. We have assumed a total cost of 35s. per ton in our estimate of the present value of the ore reserve. It is unlikely to be

less, having regard to the interruptions to operations, shaft repairs, and additional plant. However, we must not labour the point. It would not be worthy of emphasis if we had not a high opinion of the gentlemen controlling the company and of the consulting engineer under whose direction this mine is being so successfully operated.

Council of the Institution.

Recently we offered some criticism on the manner of electing members of the Council of the Institution of Mining and Metallurgy. We shall not repeat them until they become due, next spring. For the present it suffices to draw attention to the election completed on March 22. Of the 28 names submitted on the balloting list 24 had to be chosen. It is a striking fact that the 24 actually elected constitute, to a man, the present Council and that not one of the four new candidates was elected. This argues general confidence in the Council as it now stands; it appears to indicate lack of interest in the election; and it may suggest the perfunctory character of the entire performance. We believe it does bear all three interpretations; and of the three, the latter two are regrettable. Undoubtedly some rotation in the composition of the Council would be pleasant, as well as useful; it would give a touch of reality to an annual expenditure in postage and stationery. Moreover, it may be said in all frankness that while the Council does excellent work and has deservedly won the appreciation of the general body of members, it includes several men who might advantageously give place to others. We would like to mention names, but forbear, being loth to hurt the feelings of gentlemen who are only guilty of sins of omission. However, we can state that at least six members of the Council show so little regard for the duties devolving upon them that they rarely attend either the Council or the general meetings. One of them is prevented from doing so by reason of a

resident appointment in Western Australia, another is an authority on the metallurgy of gold and a scientific man whose papers formerly enriched the proceedings of the Institution, another is so busy in distant regions that he is unknown at the general meetings, two others are veteran mining engineers resident in London and quite able to attend the meetings, but they appear to consider the task ungenial. At least half a dozen members of Council givenooutward and visible sign of an appreciation of the duty reasonably to be expected of them. On the other hand, among the four new names submitted were at least two, Messrs. Henry C. Taylor and Edmund W. Janson, that in attainments, standing, and general regard would have strengthened the Council by becoming parts of it. If such men stand no chance of election, no first-rate man will consent to be a candidate. We shall then have a persistent Council, the members of which will be removable only by death or misadventure, and only replaceable by second-rate men. The matter is well worthy of serious attention, and we commend it to those who are responsible.

Values.

Insistence on details of verbal usage will annoy some people but it may prove useful to others, who are more receptive; therefore we venture to make a criticism on the employment of the word 'value' in mine reports. For example, in the report of the Crown Mines it is stated that the reserve of ore consists of 7,300,000 tons "of the value of 7'6 dwts." It should be 'dwt.', but that is a minor point. An ore that contains 7'6 dwt. per ton has not the 'value' of 7'6 dwt., which is about 32 shillings, for from that amount must be subtracted the costs of treatment and realization. The 'value' of a 7'6 dwt. ore in the Crown Mines is 32 shillings *less* a working cost of 18s., or 14 shillings. Therefore an engineer should state that the ore reserve is estimated at 7,300,000 tons having a value of 14 shillings per ton, or he might

say that the 7,300,000 tons will yield 7'6 dwt. per ton. We presume that the 7'6 refers to yield per ton or to gold actually extractible by milling and not to the assay of it as sampled in the mine. If it means the latter, it is only second cousin to an expression of value, for that can only be ascertained by deducting the loss in treatment and the cost of realization. The assay-value of an ore is, of course, a useful item of information, but only to those who know the other side of the account. In many of the Rhodesian reports on reserves the average assay of the ore is quoted; in others, the estimated yield; in such cases the information is so incomplete as to be misleading. Another example is afforded by Mr. H. A. Piper's report on the Falcon. We refer to this because Mr. Piper is an engineer of unquestioned ability and we make it a practice to criticize the performances of people whose doings count rather than those whose example is negligible. In the Falcon report we are told that a cross-cut "has come into *values*, as follows: The west side assays 3'2 dwt., whereas the east side gave only 1'9 dwt., and there is practically no copper. Other cross-cuts are being put in to prove if *these values* continue, but it is a broken section of country, and *the values* appear to jump from footwall to hanging-wall side." The italics are ours. We appreciate the correctness of writing 3'2 dwt. and not 3'2 dwts. and we venture to suggest that "footwall" should be 'foot-wall.' Hanging wall is not hyphenated except when used in an adjectival way, as above, where the hyphenation is proper. But a much more important detail is the use of 'values.' Here it is applied to ore that is obviously unprofitable. Rock containing from 1'9 to 3'2 dwt. gold and traces of copper is not payable. It has no economic value in Rhodesia in 1911. Moreover even if it were 19 to 32 dwt. ore, that is, ten times as rich, it would be incorrect to speak of the valuation as if it were a concrete thing; you might as well pursue a quadratic equation with a locomotive. It may be objec-

ted that this is placing irritating emphasis on non-essentials, but we demur to that view of the matter. The error goes deeper. It obscures the essential meaning of technical descriptions. The whole Falcon report is in the air, in which 'values' are flying like autumn leaves. A low-grade gold ore containing copper in the middle of Africa has no 'value' unless it may be inferred that the valuable metals can be extracted profitably. Is such ore to be cyanided or concentrated, and if so, at what cost? Until this is explained the whole affair is nebulous. By using terms of precision thoughtfully we shall best recognize the fact that successful mining depends upon the application of science to business.

The Copper Outlook.

The statistical position as regards copper has been made clearer during recent years by the publication of reliable data every month by the American Copper Producers' Association, and by the statements made available during the last six months concerning the stock of metal on hand at Rotterdam and Hamburg, in addition to the monthly statistics covering the tonnage of copper in France and England. The American position during 1910 and up to the beginning of the current year may be summarized thus:

	Tons.
Stock on December 31, 1909.....	63,288
Production during 1910.....	648,268
Domestic deliveries during 1910.....	334,563
Foreign " " "	322,514
Total " " "	657,077
Stock on January 1, 1911.....	54,479

Thus the stock of metal in America decreased 7809 tons during the twelve months. It is to be noted, however, that the United States Customs report the export of only 315,851 tons, showing a discrepancy of 6663 tons as against the figures given by the Producers' Association. Much stress has been placed on this difference and it has been exaggerated by a striving to be sensational. There is good

reason to believe that no significance need be attached to the discrepancy, which is due mainly to the fact that the monthly amount dispatched from the refineries is not necessarily the same as that put on board the steamer or passed over the frontier. For the rest, if any error exists it is more likely to be in the Government's figures than in those of the Association.

European stocks are estimated as follows :

Date	Tons
December 31, 1909.....	109,030
December 31, 1910.....	83,838
Shrinkage.....	25,182

Thus there is an apparent total shrinkage of stocks amounting to 34,000 tons, equivalent to 4% of the total world's output of copper. This shrinkage ought to indicate a swing toward relatively increased consumption, but the fact is that the market is still under the threat of a supply in excess of the demand.

The world's production of copper in 1910 is estimated at 852,950 tons as compared with 839,000 in 1909, 754,000 in 1908, 713,000 in 1907, and 594,000 in 1903. Thus the increase was only 13,950 tons, which was distributed among many regions. The biggest increase was in Peru, where the Cerro de Pasco helped to augment a production of 18,650 tons in 1909 to 25,500 tons in 1910. The largest decrease was in the United States, which yielded 490,280 tons in 1909, as against 484,890 tons in 1910, the difference being 5390 tons. These figures also suggest the relative importance of the American output, which represents 57% of the entire world's yield of the metal. Indeed the American idea of intense exploitation coupled with the equally American proclivity for a reckless optimism has repeatedly thrown the European copper market into a condition verging on panic. It is true the threat of a rapidly increasing output of copper in America was accompanied by the promise of a 'merger' or big consolidation of mining companies that was to compel a curtailment in the lavish

production of metal, but cool observers on this side had but little belief in the efficacy of any artificial restriction of output. Vivid memories of two previous attempts by the Amalgamated group to 'corner' copper served to provoke keen distrust, and just when the merger was rumoured to have been effected it was authoritatively denied. Any comprehensive amalgamation of copper companies was checked by the fear of interdiction by the Supreme Court, then engaged in an enquiry into other monopolistic combinations supposed to be illegal because "in restraint of trade." However, the amalgamation of the Utah Copper and the Nevada Consolidated companies was effected in the early summer of 1910, and was followed by a slight retardation of output in August. The effect of this was not shown at once in the American statistics for between the time the copper is extracted at the mine and the time when it is placed on the market an interval of about three months must elapse. Thus the Utah Copper's output declined from 3950 tons in May to 3186 tons in December. Similarly the Nevada Consolidated reduced its production from 3080 tons in July, to 2460 tons in December. During the last quarter of the year the Amalgamated, Calumet & Hecla, and Phelps, Dodge & Co. mines were worked on a reduced scale. Undoubtedly these groups did come to some sort of an agreement among themselves and with the Rio Tinto to restrict their output; on the other hand several important mines, especially new ones exploiting deposits of disseminated copper, did not decrease their efforts, so that the supply of copper showed less diminution than was predicted. In August an American production of 57,035 tons was attained, the first six months of 1910 showing an average of 53,367 and the next six months 54,673, proving that the promised curtailment was ineffective. Since then January and February have exhibited a decline to 51,650 and 49,030 tons respectively. This looks promising, but during the first two

months of 1911 the foreign deliveries of American copper have decreased, the net result being a growth in stocks to the extent of 9112 tons in January and 6334 tons in February, so that on March 1 the total stocks had risen to 69,924 tons, as compared to 54,479 tons at the end of 1910, and 47,852 tons a year ago. With the European surplus the total copper on hand now amounts to 152,311 tons, as against 161,300 tons a year ago. The price of copper has been falling since 1906 when the average price for the year was £86, as compared to £57 in 1910. During the last 12 years the price has averaged £56 $\frac{3}{4}$, so that the present quotation of £54 represents a low ebb.

The amount of copper thus on hand, however, is relatively small and would not constitute a menace if only consumption grew at the normal rate. In America consumption has increased during the last ten years at an average rate of 7 $\frac{1}{2}$ %, and during the same time the world's consumption of the metal has increased at the rate of 6 $\frac{3}{4}$ %. Last year the total production increased about 1.6% and that of America decreased 1.8%. The general industrial prosperity of the chief copper-using, that is, the most progressive, countries is such today as to warrant the expectation of an increased rate of consumption. Electrification of local railways has only been begun and other new uses for the metal are growing. Thus the general condition is healthy and the outlook would be good if the market were not subject to artificial checks and to manipulations connected with gambling both in the metal and in the shares of mining companies producing copper. During the past year the Amalgamated group has bought copper in London when the market weakened and has transferred copper to this side when stocks at New York threatened to become too big. Anaconda and Amalgamated shares have sold on the market at a price yielding 2 to 3%, so that obviously the winning of copper was subordinated to the game of the Stock Exchange.

This is true of other mining companies in America. Today copper sells for 11 $\frac{1}{2}$ cents per pound at New York, yet it is a fact that one-third of the American production is won at a cost of between 11 and 12 cents per pound, and fully one-quarter of the total output is being produced at a loss. Among these are the Butte mines, several in the Lake Superior region, and one or two of the older Arizona ventures. Mr. James McNaughton, general manager of the Calumet & Hecla, recently stated that out of the total Michigan output not less than 55,000,000 lb., or one quarter of the entire production, is obtained at a loss. Such copper confers no benefit on the owners of the mines but it affords a counter for gambling; incidentally, it spoils the market for other mines that are mining copper successfully. Again, the recent development of enormous masses of low-grade ore of the disseminated type in Arizona, Nevada, and Utah, capable of yielding large quantities of copper cheaply, has tended to weaken the price. Naturally if an increasing proportion of the copper output can be won at a cost much below the market price then the quotation will fall. A further contribution of cheap copper is impending from the Miami and Ray Consolidated mines in Arizona, and the Chino in New Mexico. The two first mentioned have just begun milling. Together they are estimated to have 100,000,000 tons of 2 $\frac{1}{2}$ % ore, while the Chino is credited with 45,000,000 tons of 2.3% ore. The Inspiration and Live Oak are also being prepared for production. Evidently the American output is not likely to diminish unless unprofitable mining operations are discontinued at some of the older mines, and to this may be attached the remark that many of the mines of the disseminated class are likely to prove disappointing, the estimates being based on imperfect sampling and optimistic assumptions of an extremely low cost of exploitation. Some of those that are now doing well are not working average ore and will have to in-

crease their expenditure as the proportion of barren overburden to be removed is increased with enlargement of the open-cuts. Rio Tinto itself is an example.

We conclude that if the laws of supply and demand were allowed free play, if some mines ceased to glut the market with an unprofitable product and others were not started merely to afford scope for promoters and brokers, the copper market would soon find a healthy level. Our American friends, like both Canute and Mrs. Partington, have assumed that the tide would stop at their bidding and they have suffered from wet feet in the vain effort to check natural laws. So long as the copper market is subject to manipulation and artificial check, it must remain in a precarious and dangerous state. That is the position today.

Gold in Outcrops.

Secondary enrichment is often confounded with primary impoverishment. Like other scientific words having a definite significance this comparatively new geological term is apt to be used as a cloak for ignorance. If the upper workings of a mine are poor, we may be told by the agent of a vendor that such poverty is due to a leaching that has transferred the richness to a lower horizon at an indefinite depth; but if the outcrop is rich we are asked to look upon it as a sign of assured richness lower down. Indeed, the migration of metals caused by chemical solution is used as a wilfully confusing argument by some people and as an unintentionally bewildering explanation by others. For instance, at the statutory meeting of the Golden Bullfinch company, the chairman gave sundry inconclusive reasons for believing that the mine was a promising prospect and among other opinions he quoted that of a Government Inspector of Mines. This official gave his version of secondary enrichment at Yilgarn in such phraseology as might encourage unwarrantable hopes of improvement in depth. The Golden Bullfinch

lode is poor at surface, whereupon Mr. Inspector writes concerning "concentration caused by descending waters" and surmises that "in their downward course an enrichment of the sulphides has been brought about, and that below the oxidized zone gold in profitable quantities will be obtained." Hence he considers it inadvisable "to place much importance on results obtained from shallow workings." The lodes should, he says, be prospected "to a depth of at least 100 feet." If now we apply this reasoning to the Bullfinch bonanza, we might conclude that the rich ore is but the cap of a much richer body of ore, instead of having a sneaking idea, based on worldwide experience, that specimen ore near surface may be succeeded by poor sulphide ore below the level of ground-water. The brutalities of fact would lead an experienced man to agree with Mr. Inspector that inferences from shallow workings are unreliable and would impel him to second the proposal to defer an opinion until the rich lode no less than the poor one had been prospected at least to a depth of 100 feet, which, in Western Australia, means below the water-level. Hence anyone but a sanguine promoter or a simple-minded speculator would hesitate to take the superficial richness of the Bullfinch Proprietary as representing the average of the lode for several hundred feet in depth and would rather be inclined to impute the poverty of the Golden Bullfinch to primary impoverishment than to secondary enrichment. Let us explain:

Gold is readily precipitated when in solution, but as a metal it is soluble with difficulty. It is leached much more slowly than the baser metals, such as the iron of pyrite. For this reason the gold associated with the iron pyrite of a quartz vein is apt to survive the effects of weathering; by the migration of the more soluble parts of the ore and the removal of the lighter portions of the matrix, the gold may become concentrated in the outcrop. The chemical decomposition due to surface waters,

which are powerfully oxidizing, may turn the iron sulphide into a soluble sulphate, disintegrate the quartz, and leave the gold. These effects are observed down to the water-level and for a little way within the water-zone, for to that depth the waters carrying free oxygen can penetrate without losing their distinctive character. As erosion proceeds and the surface is scored away, the gold-bearing quartz is more resistant than the enclosing rock, but not without loss: so that the result of these natural operations is to leave a silicious comb jutting above the ground; this on closer examination will be found to consist of honey-combed quartz full of cavities formerly occupied by pyrite and in them small particles of the gold liberated from association with the pyrite. Thus a rich gossan is formed. It is a process of concentration due both to chemical and mechanical causes. The gold in the rich outcrop is derived from a body of vein-matter that has been eroded, the light quartz and the soluble pyrite having been removed while the relatively heavy and relatively insoluble precious metal has remained to enrich the ore next exposed to weathering. Thus the gold in several hundred feet of vein becomes concentrated in the outcrop, whose form relatively to the surface may remain practically unchanged while its substance undergoes slow substitution, with a gradual concentration of the most stable element—the gold. This process is complicated by solution, which may produce local effects even as regards the gold. For gold is soluble in the sesqui-sulphate of iron, formed at one stage in the oxidation of pyrite; but this salt of iron is easily reduced to ferrous sulphate, which is a powerful precipitant for gold, and is used as such in chlorination plants. Thus the products of oxidizing pyrite affect the gold variously, aiding its removal at one time and compelling its deposition at another, according to the chemical conditions existing. Other solvents and precipitants exist, and their interplay is mutually checking to the free

migration of gold, but the general result is to cause local redistribution of the precious metal and a tendency to concentrate richness in a small portion of the vein, chiefly that portion that is nearest to the surface. On the whole, therefore, the evidence favours the idea that the best part of a vein is that easiest reached by the miner's pick; and of this we can freely say that it is an arrangement of Nature highly favourable to man. Occasionally rich ore persists to a depth great as measured by man but shallow in proportion to the earth's crust, and in these cases there is reason to believe that the vein as originally formed was sufficiently rich even below the water-level not to require superficial concentration to be profitably exploitable. In other cases, as at Kalgoorlie, the lodes themselves are soft, so as to have no outcrop and to be covered by detritus, masking them from the prospector. But the subject is too big for casual treatment and we leave it with the parting remark that Inspectors of Mines are excellent fellows for safeguarding the proper operation of mines but they are neither trustworthy geologists nor safe appraisers of ore. The less Government officials have to say about mines that are the sport of speculative dealings the better for everybody concerned.

Engineering Ethics.

The March bulletin of the Mining and Metallurgical Society of America is notable in containing the preliminary report on ethics submitted by a committee of the Philadelphia members. This committee offers to the Society at large a draft of a code embodying the principles that should guide mining and metallurgical engineers in their relations to each other, to their clients, and to the public. The gentlemen who undertook this useful task, in no bumptious spirit but in an earnest desire to perform a public service, are known to us as professional men quite worthy to lead the way even in a matter of such undoubted importance. They

were Messrs. H. M. Chance, F. L. Garrison, E. S. Hutchinson, R. A. F. Penrose, and R. H. Sanders. The report is too long for quotation in full, for it covers 29 points, embodied in an equal number of short paragraphs. When the recommendations have undergone the constructive criticism of the general membership of the Society it will be time enough to print them in full. This we shall be glad to do. The mere effort to crystallize the customs of the leaders of the profession in America into a written code of honour must have an excellent effect on the profession at large. As examples of the good sense shown in the precepts and principles advocated we shall quote two. In regard to participation, it is said: "If an engineer be asked to report upon a property in which he is interested, or to undertake any work when he has an interest at variance therewith, he should state the facts to his client before accepting the commission, and if such report is to be used publicly a statement of these facts should be embodied in the report, or his interest should be indicated in some equally effective manner." This recommendation to complete frankness and unhesitating publicity is the only preventive to the wrong that may ensue from participation. Next we quote the paragraph on contingent fees: "Experience has amply shown that an agreement by an examining engineer to accept a compensation or fee the amount of which is contingent upon the nature of the report, or upon its value or usefulness in raising capital or in effecting the sale of a property, is likely to prove detrimental to the best interests of the engineer and of the profession. While some of the objections to such agreement do not obtain when all the parties in interest understand and agree to the agreement, the practice must always involve some risk to the reputation and standing of the engineer." These examples suffice to indicate the general tone adopted. We note with pleasure that the committee will welcome the suggestions and criticisms of engineers who

are not members of the Society. In order to stimulate such assistance we have written to New York asking the secretary to send us a number of copies of the bulletin containing the report, and when these arrive we shall be glad to forward them to such British engineers as care to help in the good work.

Qualifications.

Among the prospectuses issued during the past month we note that of the Werompi Rubber and Gold Concessions, a company organized for industrial operations in West Africa. As regards the rubber we have nothing to say; as regards the exploitation of gold in old workings we desire to point out that the only advice worth having is that of men who are qualified by special training and experience in such matters. This prospectus is no better and no worse than many that are issued in London, and it illustrates a failure to recognize what we deem to be essential to intelligent effort in a useful field of industry. In the first place there is the usual array of directors, bankers, solicitors, brokers, and auditors; but no consulting engineer appears on the list of those who are to guide the destinies of the company. The enterprise resembles a ship loaded with owners, engineers, stewards, cooks, and passengers about to go to sea, among dangerous shoals and windy coasts, without a navigator. Next we note that the reports are by "Mr. R. G. Rogerson, C.E.M.E., F.R.G.S., formerly surveyor to the Crown Agents to the Colony, and Mr. Fred. A. Jackson, M.E., C.E., a licensed surveyor of the Gold Coast Colony, who surveyed the Bibiani Gold Mines and other important properties." We know neither of the gentlemen mentioned, and we are ready to believe that they are worthy and capable men, quite competent to do the work that falls upon a surveyor in the Gold Coast Colony. But such a qualification is utterly inadequate to warrant the belief that they can appraise gold min es

when operated by an English company. We deprecate the assumption that Government officials of any sort have a prescriptive qualification for advising the public in the use of money for mining enterprise; on the contrary, we are convinced from wide experience in such matters that Government inspectors, surveyors, and the like, are usually incompetent to express anything better than an optimistic judgment that is doomed to be falsified by subsequent work. In this case the judgment may be sound, but if it be so it will be an exception to a general rule. Certainly no reason for confidence is furnished by the luminous tails appended to the names of the two surveyors. We say again, as we have said many times before, that such suffixes as M.E. and C.E. are meaningless unless it be stated by whom they were conferred. What university or institution has given the technical accolade to Messrs. Rogerson and Jackson? If everybody who practises as a surveyor or a mining engineer is to dub himself C.E. and M.E. then these suffixes lose the meaning now accorded to them as the abbreviation of degrees won at the end of a special technical training. Unfortunately in most cases, but perhaps not in this case, these marks of supposed proficiency are self-imposed and signify nothing except that the bearer is engaged in civil or mining engineering. Again, F.R.G.S. is no qualification whatever for examining a mine. It is a Gilbertian travesty. Membership in a scientific society gives no assurance of special capacity nor even of ordinary scientific ability except in one case, that of the Royal Society, which constitutes the peerage of science. Fellowship in the Chemical, Geological, Geographical, and other kindred societies, means nothing except the willingness to pay dues and a possible smattering of knowledge in regard to a particular science. Such societies include the leading authorities on the subject to which the organization is devoted, but they also include a large number of mere preten-

ders. To quote membership as proof of scientific attainments or technical proficiency is mere spoofery. Finally, we do not find the names of Messrs. Jackson and Rogerson on the roll of the Institution of Mining and Metallurgy. That is the only British society of which it can be said that membership gives *primâ facie* evidence of qualification for the work of expert advice in mining and metallurgy. We are willing to concede that all the members are not above criticism and we allow that many first-rate men are not members, but the number of each of these exceptions is small, and the representative character of the Institution is such that the public will do well to look to membership as a simple and easily available test. As things go it is the only test, in the absence of personal knowledge or acquaintance with the engineer who reports on a mine.

The Zinc Problem.

In the last issue of this magazine our Melbourne correspondent gave a timely résumé of the position of the zinc-distilling industry as it affects the Australian position. The dominant note was one of regret that so much of the zinc concentrate produced at Broken Hill should be exported, and to Germany. The economic status of zinc is of perpetual interest, and the discussion of the subject at the present time will help to clear some misconceptions. The questions asked in Australia and also in England are: Why cannot metallic zinc be produced at Broken Hill or at some suitable smelting centre in Australia? and if not, why is it that the old country does not appreciate the raw products of the colonies by buying the concentrate and smelting it in England? In other words, why is it that the German firms have been allowed to secure the business for themselves? So many factors are involved and they are so much interwoven, that the logical presentation of the case is not a simple matter. The casual ob-

server ready to fling reproaches at the supposedly characteristic English man of business exclaims: "Want of enterprise!" Another, with rather more knowledge of the circumstances, says that the German and Belgian smelters know more about metallurgy than those in South Wales. A third, who has had experience in selling zinc ores, hints significantly at the beggarly prices offered. These views, like all epigrammatic expressions of opinion, contain only a bald and incomplete statement of the case, and we propose to elaborate them in detail.

It is an undoubted fact that the German and Belgian zinc metallurgists are better able to conduct distilling operations at a profit than are their confreres in England and Wales. The chief reason for this is that their operations were based on large local supplies of ore, which were favourably situated as regards fuel and clay. The mining and smelting have been continuous over great periods of time, and thus it has been possible to educate and retain a plentiful supply of cheap skilled labour. Under the circumstances it is not remarkable that zinc metallurgy on the Continent is ahead of that in this country. In recent years the supplies of ore on the Continent have shown signs of exhaustion; this fact and the thoroughness of the Continental knowledge of the subject have made it both necessary and possible to look to other countries for sources of supply.

As regards the South Wales zinc industry the distiller there has never had any dependable home supply, in this way differing from the copper smelter in the same region. Furthermore the ownership of the zinc works became inactive, as is usually the case where succeeding generations are not educated to take a direct interest in the management. Such companies are never inclined to move with the times and are practically forced to jog along with old plant as long as it lasts. According to their own statements the South

Wales zinc-distillers have been able to buy as much carbonate and silicate or sulphide low in zinc as they could conveniently handle. The owners were not inclined to launch into new expenditure on plant, nor had they any means of readily obtaining any increased number of workmen. Consequently when the Broken Hill concentrate began to come on the market they did not care to make an offer for it. They were, in fact, not ready to take zinc ores high in lead, and they thus fell behind in the industrial competition.

The reduction of zinc ore is different from the metallurgy of any other metal. Successful operations depend on the continual exercise of good judgment by both the metallurgists and the workmen. The personal element can neither be eliminated nor the process rendered automatic. The mixing of the ores, the economic limit of roasting, the charging of retorts, the avoidance of deleterious lead emanations, and the prevention of the formation of metallic zinc fume and of oxide, all demand constant skilled attention. Seeing that the selling price of zinc is low it follows that the skilled labour must of necessity be cheap. This, in fact, is the most important point to consider. The plant required is much more delicate and expensive to construct and maintain per unit of output than with any other common metal. The reduction must take place out of contact with air, so that the fuel used for heating has to be separate from that used for reducing, and this introduction of heat through the walls of the clay retort adds to the fuel cost. Moreover the improvements adopted during recent years have entailed large additional expenditure on plant, notably for the manufacture of stronger and more impervious retorts by means of the hydraulic press; this and other modifications have made it possible to treat ores with a high lead content. These modifications have made it desirable to have at least 5% of lead in the ore, instead of the smallest amount possible, as explained at

length in our article on 'Zinc at Broken Hill' last November. Thus the expense of plant and the necessity for highly skilled workmen make the zinc problem a difficult one, upon which people will not employ their capital without seeing their way clearly ahead. A study of these facts will explain the first two epigrammatic views quoted above. As regards the third allegation, namely, that Swansea buyers are not sufficiently liberal in their terms, their hard method of dealing has from time immemorial been well known. The buyers explain their attitude by saying that they can get as much material as they can handle at the prices they offer. This may be true, but it is well to remember that the same policy lost Swansea its copper-smelting business. In the old days Swansea had a monopoly in copper knowledge, and was able to dictate terms ruinous to the sellers of ore and matte. How this high-handed method forced producers of ores to re-invent copper metallurgy is a matter of history. The difference between the old copper situation and the present zinc situation is that in copper Swansea had a monopoly, and that in zinc it has not, so the distillers' explanation must therefore be the real one, and that for various reasons they are unable to extend their present equipment. That they have difficulties in securing sufficient ore at the low prices they are willing to give is evident from the fact that to make a successful buyer of ore in Swansea requires the possession of an ample supply of guile. This is in direct contrast to the methods of the Continental buyers, who explain in detail the terms on which they make their purchases.

A careful study of economic considerations tends to elucidate the problem of establishing a zinc-distilling industry in Australia, though the personal element is different from that in South Wales. The experiment of starting new zinc works is not to be embarked on rashly. The Broken Hill Proprietary has only done so after the most careful study and

preparation, and it is too soon as yet to know the results. The Sulphide Corporation was the first to erect a plant in Australia and their small distiller is still in operation, but recognizing the difficulty of the situation, proceeded five years ago to erect a plant near Hartlepool, England, where a long struggle is taking place. In contemplating the establishment of works in Australia, the most serious matter would be the provision of a competent staff of workmen, and even if such a staff were organized it is possible that the wages required in Australia would make the operating cost too high. Another point for capitalists to consider is the probable life of the Broken Hill mines, and the prospects of further supplies. As the output of Broken Hill is already sold ahead for some years the available supply for a local establishment is by that much reduced. Our own view is that the labour and the ore-supply questions do not warrant a change from the present system. There are some critics who say that the concentrate should never have been shipped abroad, and that from the beginning it should have been treated locally. Such critics have a short memory. Broken Hill capitalists and metallurgists had quite enough to worry them in connection with the concentration problem without attacking the further problem of distilling. It was at first intended to distil on the spot, and Mr. A. L. Queneau, a competent and experienced zinc metallurgist from America, was engaged to investigate and make recommendations. When he arrived at Broken Hill it was recognized that there were other problems more pressing. The concentration problem has been solved and the same critics again agitate for home distilling. Their opinions will, however, not be adopted by the owners of the mines, who rightly remember that much money and skilled labour would be required, and that a long period of construction and experiment would cancel the greater part of the profits derivable from the treatment of the present reserves of ore.

STATISTICS

STOCKS OF COPPER IN ENGLAND AND THE CONTINENT.
Reported by Henry R. Merton & Co.

	Jan. 31 Tons	Feb. 28 Tons	March 31 Tons
In England	65,872	66,239	98,938
In France	6,896	6,648	6,319
Afloat from China	3,100	3,000	—
Afloat from Australia	7,325	6,500	2,800
Total	83,193	82,387	111,457
In Rotterdam	7,600	7,600	—
In Hamburg (estimated)...	15,000	11,000	—

* Not reported for March.

AMERICAN COPPER PRODUCERS' ASSOCIATION.
In Tons of 2,240 lb.

	Production	Deliveries			Stocks at end of month
		Domes- tic	Foreign	Total	
November 1910	53,282	27,143	30,100	57,243	58,209
December 1910	55,062	19,460	39,332	58,792	54,479
Year 1910.....	648,268	334,563	322,514	657,077	—
January 1911.....	51,650	18,785	23,753	42,538	63,591
February	49,030	22,553	20,139	42,692	69,929
March	58,273	29,500	26,375	55,875	72,325

PRODUCTION OF GOLD IN THE TRANSVAAL.

	Rand	Free white	Total	Value
	Oz.	Oz.	Oz.	£
July, 1910	610,664	28,050	638,714	2,713,083
August	623,129	26,140	649,269	2,757,919
September	621,311	25,588	646,899	2,747,853
October	627,445	25,702	653,147	2,774,390
November	617,905	24,686	642,591	2,774,390
December	616,668	24,686	641,354	2,774,390
Totals, 1910.....	7,228,588	305,532	7,534,120	32,002,912
January 1911	625,862	24,686	650,548	2,774,390
February	585,683	24,686	610,369	2,594,634

COST AND PROFIT ON THE RAND.

MONTH	Paid	Yield per ton	Costs per ton	Profit per ton	Total profit
	£	s. d.	s. d.	s. d.	£
January 1911	1,754,140	27 7	17 0	10 7	924,275
February	1,614,730	28 5	17 6	10 10	874,746
March	1,767,059	27 6	17 1	10 4	913,759
April	1,763,104	28 1	17 6	10 7	927,244
May	1,785,821	28 1	17 6	10 9	958,347
June	1,766,737	28 1	17 9	10 5	921,136
July	1,814,686	28 1	17 8	10 4	937,456
August	1,834,105	28 1	17 8	10 4	961,304
September	1,835,647	28 3	17 11	10 4	942,330
October	1,868,718	28 6	17 9	10 3	952,161
November	1,800,371	28 6	18 0	10 7	951,773
December	1,827,423	28 0	17 11	10 5	952,574
January 1911...	1,865,232	28 0	17 11	10 1	930,059
February	1,712,198	28 6	18 3	10 1	930,059
Totals and aver- ages for 1909...	20,543,759	28 11	17 1	10 6	11,794,376
Notes for 1910	21,432,541	28 6	17 1	10 6	11,216,105

NATIVES EMPLOYED IN THE TRANSVAAL MINES.

	Gold mines	Coal mines	Diamond mines	Total
October 31	180,103	8,528	8,068	196,699
November 30	178,027	8,367	8,362	194,756
December 31	178,602	8,354	9,939	196,895
January 31.....	183,268	8,357	9,991	201,616
February 28.....	189,434	8,357	9,814	207,761

GOLD OUTPUT OF INDIA

Year 1909	Year 1910	March 1911	1911 to date
£2,083,901	£2,104,858	£177,708	£521,414

PRODUCTION OF GOLD IN RHODESIA.

MONTH.	1908	1909	1910	1911
	£	£	£	£
January	199,388	204,666	227,511	207,903
February	191,635	192,497	203,888	203,055
March	200,615	202,157	228,385	—
April	212,935	222,700	228,213	—
May.....	223,867	225,032	224,888	—
June	224,920	217,600	214,709	—
July	228,151	225,234	195,233	—
August	230,792	228,296	191,423	—
September ..	204,262	213,249	178,950	—
October	205,466	222,653	234,928	—
November.....	196,668	236,307	240,573	—
December.....	217,316	233,397	199,500	—
Totals.....	2,526,007	2,623,788	2,568,201	—

PRODUCTION OF GOLD IN WEST AFRICA.

MONTH	1909		1910		1911	
	Oz.	Value	Oz.	Value	Oz.	Value
		£		£		£
January	22,817	91,112	17,357	70,699	15,903	66,107
February	21,403	86,210	16,976	68,469	15,179	63,081
March	23,186	93,556	17,627	71,954	—	—
April	21,001	88,071	16,363	67,069	—	—
May	27,184	100,056	16,590	68,355	—	—
June	17,430	70,561	17,194	70,988	—	—
July	17,331	70,523	15,564	58,551	—	—
August	17,709	71,614	13,921	57,713	—	—
September	18,125	72,963	11,497	47,746	—	—
October	15,957	65,813	13,341	55,046	—	—
November	17,882	73,824	14,021	57,658	—	—
December	17,570	71,332	15,042	61,737	—	—
Totals	235,972	955,635	185,493	755,985	—	—

PRODUCTION OF GOLD IN WESTERN AUSTRALIA.

MONTH.	Export oz.	Mint oz.	Total oz.	Total value
				£
Total, 1910 ...	363,496	1,209,856	1,573,352	6,682,042
January 1911	17,463	102,035	119,498	507,592
February	22,047	84,991	107,038	454,666
March	12,296	93,267	105,563	448,426

OTHER AUSTRALASIAN GOLD PRODUCTION

	1909	1910	March 11	1911 to date
	£	£	£	£
Queensland	1,916,468	1,840,337	115,100*	217,910*
New South Wales	869,546	803,727	45,681	178,785
New Zealand	2,006,910	1,896,322	168,494	670,643
Victoria	2,897,340	2,422,700	305,300*	439,300*

TODAY'S MARKET

	Tons	Value	Average
Year 1910	6,102	£619,000	£101 9 0
January 9, 1911.....	215	£23,778	£110 19 0
" 23, "	200	£23,121	£115 3 5
February 6, "	245	£22,409	£113 4 3
" 20, "	14	£24,721	£105 10 8
March 6, "	20	£23,812	£108 9 8
April 3, "	3	£24,776	£114 8 4

Owing to the Easter Holidays we have had to go to press early, and consequently it has been impossible to include some of the March figures.

METAL MARKETS

COPPER.

Average prices of cash standard copper:

March 1911	February 1911	March 1910
£54. 16s. 4d.	£55. 1s. 7d.	£59. 7s. 2d.

The market has been halting and hesitating throughout the month with no pronounced tendency of more than temporary character. It is indeed remarkable that at a time when consumption in Europe has reached record figures, the present low prices should continue month after month to move within such narrow compass, and still more that the volume of transactions on the exchange should have reached low water mark. The direct contact between the American producer and the European purchaser is undoubtedly responsible for this result.

Since the issue of the American statistics early in March disclosing an increase in stocks with a falling off in production, the improving tendency in prices has been checked and the market has drifted. Three-months copper moved between £55 and £55. 17s. 6d. The low price is attracting buyers in this country.

LEAD.

Average prices of soft pig lead:

March 1911	February 1911	March 1910
£13. 2s. 11d.	£13. 1s. 11d.	£13. 2s. 9d.

Lead sales have been desultory and prices show a slow but steady decline. The metal is not plentiful but holders are easy and buyers shy. The latter persist in taking no interest in forward purchases, and have been encouraged to buy for spot delivery by the releasing of considerable quantities of lead hitherto held in warehouse and by the premiums which the syndicate have been asking for forward contracts. In the absence of consumer's demand, dealers have used the opportunity to make small bear sales to lower the quotation.

SPELTER.

Average prices of ordinary brands:

March 1911	February 1911	March 1910
£22. 19s. 2d.	£23. 3s. 10d.	£23. 0s. 7d.

The galvanized iron trade has been agitated by the failure of an old established firm of note in Staffordshire, and the recent activity has given way to dulness and depression. Trouble also seems to be in store for the Galvanized Iron Association, as is usual when

orders are scarce. The importation of a few lots of American spelter into Liverpool has disturbed both the buyers and the syndicate, but the quantities of American spelter available for export are necessarily limited.

TIN.

Average prices of cash tin:

March 1911	February 1911	March 1910
£182. 12s. 4d.	£189. 12s. 10d.	£147. 4s. 11d.

Doubts have been expressed as to whether the syndicate is still in full control, but a perusal of the course of prices shows precisely the same rapid and great variations as have obtained during the last few months. While consumption is maintained at its present high level manipulation becomes comparatively easy, and those in control of the market have not failed to make full use of their opportunities. Whatever causes may have operated to send the price down to £173, a falling off in demand was not one of them, and recovery to over £190 was rapid as soon as pressure was removed. London stocks are still being heavily drawn upon. Standing at 7350 tons in January they are now well under 5000 tons. America has sent a constant stream of buying orders and the March deliveries there surpass all previous records. At the Banca auction 2500 tons of tin was sold realizing an average price of £187. Contrary to custom the London market was not on this occasion manipulated to a lower level previous to the sales, and as buyers were numerous a strong tone was created. The East has shown great reserve and the shipments thence are rather small. The statistical position remains excellent.

OTHER METALS AND MINERALS.

Prices quoted on April 6:

SILVER.—24 $\frac{3}{4}$ d. per oz.

PLATINUM.—160s. per oz.

BISMUTH.—7s. 6d. per lb.

ALUMINIUM.—£68 per ton.

NICKEL.—£170 per ton.

COBALT.—9s. 9d. per lb.

ANTIMONY.—£34 per ton.

QUICKSILVER.—£8. 17s. 6d. per flask of 75 lb.

MANGANESE ORE.—8d. to 9d. per unit (1%).

IRON ORE.—Cumberland hematite 20s. per ton at mine. Spanish 21s. 9d. delivered in England.

PIG IRON.—Cleveland 46s. 9d. per ton. Hematite 63s. per ton.

WOLFRAM ORE.—35s. 6d. per unit (1%).

DISCUSSION

Our readers are invited to criticize anything appearing in this magazine and to discuss other subjects of general technical interest.

Drag-Line Excavator.

The Editor:

Sir—Only received my copy of the Magazine a few days ago, owing to travel. In the issue of November 1910, Mr. J. Power Hutchins says of the drag-line excavator used by the Orsk Goldfields, of Eastern Siberia, on page 360: "It has never been used before in placer mining." I happen to know that William Deisthorst has used this type of machine for 3 years on Clear Creek, in Shasta county, California, and I am reliably informed he has used it for some 10 or 12 years in northern California. Deisthorst loads on the out-haul instead of the return, but it is the same system only slightly different in application.

W. E. THORNE.

On board S.S. *Vasari*, February 2.

Critical Moisture in Tube-Mill Feed.

The Editor:

Sir—In 1908 I was led to investigate the discharge of quicksand through orifices. The principles governing these flows were studied and applied, and it may be of interest to note that conical classifying feeders—similar in nearly every respect to Caldecott's classifier—have been in use in the Mining Laboratory of McGill University for nearly three years. Consequently, when Messrs. Caldecott's and Smart's papers* on this subject appeared, it was a matter of no little surprise to me to learn that they had independently evolved a piece of apparatus which up to that time I had considered a pet project of my own. I have read their articles and Mr. Walter Neal's paper† on diaphragm-cones with a great deal of interest, and hope at a later date to publish a few notes on the same subject.

However, in this letter I shall confine myself to a consideration of Mr. Neal's conclusion that there is a critical percentage of water (about 39%) in the feed to a tube-mill, above and below which the grinding efficiency rapidly decreases. The curve that Mr. Neal shows corroborates his conclusion in a very striking manner and certainly a peak efficiency so marked ought to be amenable to explanation.

In an attempt to account for this, I have been impressed with the fact that Mr. Neal's

critical moisture is within two or three per cent of the voids in average sand samples. It is plain that the manner in which the weight per cubic foot of a sand sample is determined has a definite bearing on the result obtained, and the following simple experiments were carried out to get some light on this point. The sand used in these tests was a stamp-mill product (—18 mesh) with the bulk of the slime removed in a two-foot conical classifier. The specific gravity of the sand was 2.79 and the corresponding weight per cubic foot 174 pounds.

Experiment No. 1. Determination of voids.

Dry Sand.

A bottle of capacity 0.079 cu. ft. was filled with sand, without shaking or jarring. The results were:

Weight of dry sand, 7.91 lb.

Weight of sand per cu. ft., 100 lb.

Percentage of voids, 42.5.

Experiment No. 2. Determination of voids.

Wet Sand.

In this test the bottle was partly filled with water and the dry sand poured in from a box containing a known weight. The bottle was rocked or jarred from time to time and sand added until it was filled to the mark. The weight of dry sand used was determined by difference.

This method was adopted on account of the contraction of volume that takes place when water is added to dry sand. It seemed probable that the closest arrangement of the sand particles in a tube-mill could be more nearly approximated in this way. The results were as follows:

Weight of dry sand, 8.59 lb.

Weight of sand per cu. ft. 108.5 lb.

Percentage of voids, 37.7.

From the foregoing it seems probable *that the percentage of water which should be present in the tube-mill feed is numerically equal to the percentage of voids in the sand inside the mill.*

This seems rational because when the water and sand in the mill are in these proportions, the sand grains are most intimately in contact throughout the mass. With a greater or less percentage of water it would seem that the sand grains are either too mobile or not sufficiently so.

Perhaps the only point of economic interest is that this theory would indicate the necessity for increased or decreased dilution of the feed in the case of sands with high or low percentages of voids respectively. These differences may be very slight, but small differences in

* *Journal of the South African Association of Engineers*, December 1908.

† *Mining and Scientific Press*, April 2, 1910.

drummen apparently have a remarkable effect on the grinding efficiency of a tube-mill, as has been pointed out by Mr. Neal.

In conclusion I may say that an investigation of tube-mill efficiency is being carried on by Mr. H. S. Ball and associates, in the Mining Laboratory of McGill University, and while it is as yet too soon to make any statements of the results so far obtained, enough has been done to corroborate Mr. Neal's conclusion that there is a definite critical dilution of tube-mill pulp. The full results of these experiments, which promise to be interesting, will be published at an early date.

JOHN W. BELL.

Montreal, February 28.

Chuquitambo.

The Editor :

Sir—In an article in your last issue entitled 'Progress in Peru,' by Lester W. Strauss, reference is made to the Chuquitambo mine. Mr. Strauss states that "Only the free gold is recovered, which amounts to 50% of the total content, or about 8s. per ton."

In connection with this statement the few following remarks may be of interest: The value of the ore sent to the mill has varied from $2\frac{1}{2}$ to 5 dwt. gold per ton. Many thousands of tons of $2\frac{1}{2}$ dwt. ore and many thousands of tons of ore up to 5 dwt. per ton have been milled, and the recovery from the plates has been from 60 to 68%. The tailing in the former case, which has averaged under one pennyweight, has gone direct into the river, while in the latter it has run as high as 2 dwt. and has been stacked for future treatment.

The total cost of mining and milling is 6s. per ton, which will be reduced as soon as the development work now in hand, and in contemplation, is carried through. At present the ore is conveyed round the hillside by tramways and lowered into the millbin by an inclined plane.

The ore occurs in lenticular masses of great dimensions. Recent developments in depth have been highly satisfactory. Only this week the continuation of a deposit of good-grade ore has been cut in the present lowest cross-cut tunnel, 330 ft. below the adit above. The width of the deposit in the upper adit workings is 30 ft. In addition to this deposit, two large and one small deposits have been intersected in this lowest adit, and by continuing it a further 200 ft. it is expected that another deposit, showing a width of 20 ft. in the adit above, will be intersected. The starting of a still lower cross-cut immediately behind the mill is now

in contemplation. The length of this adit will be about 3000 ft. and will give a further 200 ft. of backs and permit of the ore being carried direct from the stope-chutes into the mill-bin.

A plant for secondary treatment of the tailing is also under consideration and will shortly be installed.

FRANK MERRICKS.

London, April 6.

Mining Speculation.

The Editor :

Sir—I have read with interest your recent article on this subject. Your main thesis will not, I think, be seriously disputed. It is beyond question that the fluctuations of nearly all mining shares over a given period exhibit greater variation than the aggregate of dividends; that the speculator is a more important factor in mining finance than the investor; that shareholders often receive information after others have profited by it, and that on balance the public lose their money. These propositions are all true, and I imagine that they will continue to be true so long as our civilization is organized on its present basis. Moreover, I confess to feeling a degree of scepticism amounting to distrust, of any formula which is designed to enable the mining public to make profits by rule of thumb. To a large extent the difficulties are inherent in mining, and to an even larger extent they are inherent in human nature. Mining is, and must be, essentially speculative. Hard experience has convinced me that the engineer who bases a confident forecast on what lies beyond his pick on geological grounds is often the most fallacious of all guides, the most expensive of all advisers. We have fallen into a loose habit of referring to mining on the Witwatersrand as a stable industrial enterprise in which the margin for imagination is so slight as to kill speculative activity. But in the light of actual facts what nonsense it all is! Outside a few mines on the central Rand there is no single area, the gold contents of which can be figured out with even approximate accuracy, and when grade, faulting, working expenses, and all the other factors are taken into account any estimate of net profit is likely to be sufficiently wide of the truth to satisfy the gambling instincts even of a Jubilee plunger. If this be true of the Rand, with its high industrial organization, its relative regularity of formation, and the stable demand for its product, it is doubly true of mining in nearly every other part of the world. Necessarily mining makes its appeal to the

speculator rather than the unimaginative investor, and I expect that it will continue to do so despite the scientific advance of late years. I do not think that the proposition which you enforced with some detail in your last issue, that the variation in the price of shares always exceeds the dividends over a given period, really affects the question. The same observation applies to Consols or any security in which there is an active market, but no doubt the disproportion is greater in mining shares. Having arrived, however, at the conclusion that the speculator, that is, the man who is concerned rather with the variation in price than with the dividends paid, is an essential factor in mining, it is certainly a distressing feature of the situation that he should on balance lose money. It is none the less quite obviously true; but here again it is just as true of other forms of speculation as of mining. The mere machinery of speculation is complex, and hugely expensive. Its personnel is enormous and highly remunerated, more highly no doubt than the social service actually rendered would justify. None the less it is not difficult to defend the existence on broad social grounds of the brokers and jobbers, the financiers, and the rest of the comfortable gentlemen who make an ample living as portions of the machine. So long as mining demands large concentration of capital, so long as that capital can only be found by joint-stock companies with limited liability, so long as mining continues to appeal to the speculator who demands that his security shall be marketable, so long will these middle-men continue to flourish. If they ceased to perform their functions for twelve months our whole civilization would be profoundly modified. Mining shares would cease to be readily bought and sold, and capital would gradually, and in an increasing degree, cease to engage in it; there would be a famine of nearly all commodities; and a millennium of high thinking and low living, culminating in something very like starvation for large masses of people, would be inaugurated.

It is certainly unfortunate that an increase of the wealth of the world should be accompanied, and even to some extent dependent upon, the loss of the individual, but there is, I think, no flaw in the logic which leads to this paradoxical conclusion, and in any argument which purports to arrive at first principles, it is a mistake to blink it. But having admitted that gambling is inseparable from mining, it follows that it is incumbent upon all concerned to secure for the public a square

gamble. Here too, however, it is desirable that we should clear our minds from cant. No formula that the wit of man can devise is capable of relieving the fool from the consequence of his folly, though it may quite easily create a sense of false security. *Caveat emptor* is a maxim of abiding truth, and the punter in mining shares should keep it in mind. I am open to conviction, but I doubt whether even *The Mining Magazine* could frame a set of rules for engineers and directors which is capable of general application in all circumstances. Take, for example, the apparently simple question of the publication of information. Obviously all information cannot be published; apart from the expense, it simply would not be read. If it is to be edited and selected, it is impossible to determine in every case the exact point at which the development to which it refers becomes really significant. I was once a director of a quartz mine which for many years paid enormous dividends to its shareholders. Finally a poor zone was reached, with occasional patches of rich ore. At first, when these patches were encountered, information was cabled home and immediately published, with effects upon the market that were spectacular but disastrous. Then the management became more cautious, and developments were not cabled until they had reached a point at which they began to have some real significance. The result was hardly more satisfactory. The miners had friends outside and they speculated on the least variation of grade, for a long time without success, but when finally a real improvement began the information had been privately cabled and acted upon before the board had heard of it. I doubt whether any general rule can be laid down that would not be open to as many abuses as those it was designed to cure. I see that you, Sir, have suggested that the confidential observations of the mine manager, the hopes and fears sometimes expressed freely in his letters, because he knows that he will not be bound by them, should be published. One objection is that if the manager knew that these observations would be given to the world he might not make them, another is that at the best you are merely shifting responsibility from the board as a whole to one man, who would be unchecked and uncontrolled, and for whose incorruptibility there is no guarantee. As a general principle the ultimate responsibility for decision should rest with those whom the shareholders directly appoint and control, and in practice the only remedy for the grosser class of evils is to be found in a higher stan-

dard of fiduciary obligation on the part of officers of public companies. One must guard against being too optimistic in this matter. The City of London is not the Kingdom of Heaven; if it were, office rents would slump violently and fully nine-tenths of those who now earn a living within the city walls would have to look out for other and less interesting occupations. But although while human nature remains the same the stern struggle between buyer and seller will go on, and a certain difference between ethical theory and practice will be manifested, I think there are good grounds for believing that the standard of those engaged in mining, whether as promoters, engineers, or directors is higher than it was some years ago, and that the improvement is progressive and continuous. Wild-cat promotion is certainly rarer than it was, and the mining financier who thinks that money paid in dividends is money diverted from its legitimate object, would under present day conditions, hardly earn a better living than his legitimate relative in the sphere of morals who operates on the racecourse with a thimble and a pea. Mining engineering is now one of the scientific professions, a high standard of technical knowledge is demanded and is forthcoming, and, what is of equal importance, a high code of professional conduct and etiquette has been set up, and is for the most part observed. In all these respects the contrast between the conditions today and those obtaining ten years ago is striking and unmistakable. There still remains the mining director, and here perhaps progress is less apparent. High sounding titles or distinguished service in some wholly unrelated sphere of activity no longer attract as they once did, but we still have with us the amiable inefficient amateur, who is innocent of all knowledge of mining, of business, or of men, under whose complacent direction the most serious abuses can flourish like a green bay-tree, unchecked and even unnoticed. His day, I believe, is nearly past. It has hitherto been the custom to speak contemptuously of the guinea-pig, and not without good reason, but I believe the interest of shareholders would be well served if there arose a class of professional mining directors, men who frankly earned their living by looking after mining companies and were not ashamed of it, but whose remuneration, like that of other professional men, depended upon a knowledge of their work, their general efficiency, and their reputation for straight dealing. It is, I think, in this direction, rather than in attempting to devise formulas of general

application, to which we must look for improvement; but when all is said, there will still remain the possibility of abuses; ceaseless vigilance will still be demanded; and I have no doubt that for many a year it will be necessary in the interest of the public for *The Mining Magazine* to perform those functions of impartial criticism and analysis which it has fulfilled so admirably during the eighteen months of its career.

A DIRECTOR.

London, April 6.

Indian Mines.

The Mysore and Ooregum annual reports draw attention to the fine record made by the best of the Indian mines. At the Mysore the working cost was reduced 4s., equal to a penny-weight of gold, per ton. The reserve was increased by 87,800 tons, to a total of 1,100,450 tons—the average contents not being given, however. The deepest workings are at 4445 feet on the dip and on the bottom level the ore continues to be as wide and as rich as it was overhead. This mine has now yielded 2,699,384 tons, from which £12,575,989 in gold and £6,285,844 in dividends has been won. At the Ooregum the working cost last year was diminished 3s. 2d., the working profit being 11d. higher on an output of 133,437 tons. During this period the reserve has been increased by 6952 tons, to 164,534 tons, also of a quality not stated, but presumably similar to the current output, which averages about 12 dwt. per ton. The maximum depth is 4210 feet on the dip. This mine has yielded 1,741,814 tons, from which £5,572,787 in gold and £1,844,607 in dividends has been won. Just at the present time, however, the bottom levels at the Ooregum are not in quite such good ore, but the reserves are sufficient to keep the mill at work for a year without any diminution of output, and in the meantime better results may be obtained. The Nundydroog is at present in a most excellent position. The dividend of 4½% for 1910 is the highest yet distributed, notwithstanding the facts that all expenses are now paid out of revenue, instead of some being met by the issue of new shares, and that a reserve fund is being built up. During 1910 the ore treated was 91,000 tons, and gold worth £334,748 was extracted. The reserve on December 31 was 141,296 tons and the developments at several points, especially in the 2450 ft., 2600 ft. and 2750 ft. levels in Kennedy's section, prognosticate a continuance of the discovery of good quality ore. At this mine also the costs have recently been substantially reduced.

SPECIAL CORRESPONDENCE

News from our own Correspondents at the principal mining centres

TORONTO.

Mineral Output.—The preliminary report on the mineral production of Canada during 1910, issued by the Department of Mines, gives the total value of the year's output as \$105,040,958, being an increase of \$13,209,517, or over 14% of the production of 1909. The metallic production was valued at \$49,169,826. The largest increases are in the items of silver, nickel, and pig iron. Silver heads the list with a yield of 31,983,328 oz. valued at \$17,106,604, the increase being due to Cobalt, the British Columbia yield showing a falling off. There has been a large increase in the production of nickel-copper ores in Ontario. The ore is converted into a bessemer matte containing the combined metals, which is shipped abroad for refining. The total production of matte was 35,033 tons, valued at the furnace at \$5,380,064—an increase of 31'6%. The metallic contents were 19,259,016 lb. copper and 37,271,033 lb. nickel. Statistics of gold production were incomplete, but the estimated output is \$10,224,910, an increase of about 9%. The production of the Yukon is valued at \$4,550,000, as against \$3,960,000 in 1909. Among the non-metallic products coal is by far the largest item, the total output being 12,796,512 tons of the value of \$29,811,750, an increase of 22%. There has been increased production from practically all the larger collieries and in Alberta many new mines have been opened up. The total production is almost equally divided between the Eastern and Western coalfields. Coke was produced to the amount of 897,273 tons, as compared with a production of 862,011 tons in 1909.

Mining Institute.—The thirteenth annual meeting of the Canadian Mining Institute was held at Quebec early in March with an attendance of about 200, the gathering being one of the largest and most interesting in the history of the society. The annual address of F. D. Adams, the president, reviewed its growth and progress, and dealt at some length with the problems arising from the development of the mining industry. An address of welcome on behalf of the Province of Quebec was delivered by C. R. Devlin, provincial Minister of Mines. The question of the conservation of natural resources was considered

and a resolution adopted expressing appreciation of the work of the Canadian Conservation Commission and declaring that with the increased drain made year by year on the natural resources of Canada the Institute appreciates the necessity of preserving and as far as possible perpetuating them by the adoption of reasonable means to prevent waste and encourage development along national lines. A large number of papers were read. A discussion upon the origin of asbestos following the presentation of papers by Edward Jorrey, J. A. Dresser, and others. Alfred C. Lane compared the copper deposits of the



The Timmins Mine, at Porcupine

Keeweenaw peninsula with similar Canadian deposits. Petroleum deposits were discussed in papers by D. T. Day, of the U.S. Geological Survey, and Eugene Coste, of Toronto. Much interest was created by an address on the Porcupine gold area by A. G. Burrows of the Ontario Department of Mines, illustrated by a series of stereopticon views. The following officers were elected: president, F. D. Adams; vice presidents, A. E. Barlow and Thomas Cantley; councillors, J. A. Bancroft, R. W. Brock, A. A. Cole, E. T. Corkhill, Theodore Denis, John Donnelly, E. Dulieux, F. W. Gray, G. E. Sylvester, and J. B. Tyrrell.

Porcupine.—A great impetus has been given to this district both as regards development and operations on the Stock Exchange by the transfer of 50 claims from the Tim-

mins-McMartin-Dunlop syndicate to the Bewick Moreing group. A later development is the purchase by the same parties of a large block of stock in the Hollinger, this being followed by a sharp upward movement of the stock and the nearest approach to a boom that the market has witnessed for some time in the cheaper Porcupine issues. Many holders of Cobalt stocks sold them at a sacrifice, to invest in Porcupines. The market, however, soon steadied, the advance being mainly of a speculative character and profit-taking much in evidence. The Bewick-Moreing syndicate has lost no time in getting to work and has a large force of men engaged in constructing camps on the claims at Pearl Lake and also in Northern Tisdale. A large quantity of machinery is being brought in and some has been already installed. Rapid progress is being made with the Porcupine branch of the Temiskaming & Northern Ontario railway, on which over 1000 men are at work. Five miles of rail have already been laid. Work is being pushed in the construction of a power-plant at Sandy Falls on the Metagami river, 11 miles northwest of Porcupine, in order to furnish the mines with a supply of power, which is expected to be available for transmission by June 1. A force of 400 men is at work. The dam to supply power for the generators is more than half completed. It will be 730 ft. long and will afford a 25 ft. fall of water. The total volume to be generated when everything is complete is 8000 hp., of which the Hollinger mine has contracted for 1000. The system will require 70 miles of transmission lines, for which aluminium will be used. The Pearl Lakes Gold Mines is starting to sink three shafts, which will be put down to 100 ft. before any driving will be done. At the Rea mines two shafts are down about 50 ft.; while some small pieces of rich ore have been taken out, the bulk so far is low-grade. Development work is in charge of Harold Kingsmill, who has had experience in South Africa. The McDougall claims, lying north of the Scottish Ontario group, on which free gold has been found, have been bought by Alex. Gray, the writer on mining matters, for \$50,000. H. C. Anchor, formerly of California, has been engaged to take charge of the work on the Dome Extension. J. S. MacArthur of Glasgow, who is interested in the Scottish Ontario mine, is establishing an office at Porcupine. The Dome Mining Co. will expend \$1,100,000 in an elaborate plant, machinery to the value of \$250,000 having already been purchased.

A 50-stamp mill is to be erected as the first unit of a complete equipment of 200 stamps.

Cobalt has latterly been suffering an eclipse owing to the concentration of the public interest upon Porcupine, and the interruption to operations caused by a shortage of electric power. The Nipissing has encountered high-grade ore 2 to 5 in. wide in a drift from shaft No. 122 at the 170-ft. level. This vein has been traced for 900 ft. on the surface. The Hudson Bay has lately found two more good veins, the largest 3 in. wide, on the second level and running about 2500 oz. silver per ton. The King Edward mine is to be abandoned, efforts to find silver at depth having proved fruitless. The annual financial statement of the Beaver shows earnings of \$106,856 and value of ore at smelters in transit and on hand \$143,403. The mining expenses were \$89,945. The directors state that the mine contains 2,000,000 oz. silver above the 300 ft. level. The Rochester will increase its capitalization from \$1,500,000 to \$2,500,000. The annual meeting of the Cobalt Lake Co. was held in February. The financial statement showed cash in hand \$59,243. Ore sales for the year amounted to \$84,215, and the total expenses to \$62,967. It was decided to reduce the capital from \$5,000,000 to \$3,500,000. The Crown Reserve has declared a monthly dividend of 3% and a 2% bonus. The Temiskaming has declared a quarterly dividend of 3%. The Provincial Government of Ontario has decided to impose a tax on all stock transfers of 2 cents for every \$100, or fraction thereof, of par value. A similar tax is in operation in New York and Montreal. The principal objection is that, being based on the par value and not on the selling value of stock, it will bear unduly hard on the cheaper issues of mining stock.

VANCOUVER.

The Slocan.—This part of British Columbia is undergoing active revival as a result of the success that has attended deep mining. The large body of ore proved on the 5th level of the Standard mine, at Silverton, evidently extends to the 6th level, where two feet of galena has been struck, although a distance of 200 ft. remains to be driven to reach a point under the wide shoot on the 5th level. Patrick Clark, of Spokane, who recently took a bond on the property, has selected a site for a 200-ton mill, with the construction of which it is proposed to proceed immediately. Then the Rambler-Cariboo mine, near Sandon, which was the pioneer

as regards deep mining, has proved an extensive ore-shoot running up to 6½ ft. in width of solid galena, rich in silver. The Ruth and Slocan Star mines at Sandon will resume shipments shortly. The Richmond Eureka is steadily shipping about 300 tons per month. The Lucky Jim is running the 6th level from a point close to the railway track on Seaton creek to develop at that depth the shoot of sphalerite that has been traced from the out-crop to the 5th level. A large tonnage of ore is available. The company operating this property has abandoned the plan of erecting a mill at Kaslo, and will now establish spelter works at Medicine Hat, where natural gas can be used as fuel. The mill in course of erection near Silverton for the Van Roi company, of London, will be completed and in operation in April.

Ainsworth.—This district, the pioneer metal-mining centre of British Columbia, adjoining the Slocan division on the east, is also showing renewed life. The Highland, the Highlander, No. 1, Maestro, and others are being actively developed with encouraging results.

The Silver Cup mine, situated in the Lardeau, and owned by the Ferguson Mines Ltd., of London, has been shut down and the company has gone into liquidation. The mine is one of the oldest shippers of high-grade silver ore in the Province, having been almost continuously a producer since 1895. It has been developed to a depth of nearly 1000 ft., of which 800 ft. was by three levels and 200 ft. by shaft. The ore carried about half an ounce per ton in gold, about 150 oz. silver, and 20% lead, but was penalized at the smelter on account of its high zinc content. For seven years the ore had to stand transport over 24 miles of road to navigation, but since the construction of the Lardeau railway and construction of an aerial tramway from the mine to the valley of the south fork of the Lardeau river, the road haul has been reduced to five miles, and the shipments averaged

The Portland Canal Mining Co., which owns the principal mine on Portland Canal, has made a first shipment of ore to the Tye Copper Co.'s smelter at Ladysmith, but returns are not yet available. The management claims that the mine is making a profit of \$80 per day. There is a supply of ore sufficient to run the mill for two years, and the reserve is showing a steady increase under development. Additional plant to double the capacity of the mill has now been ordered.

Smelter Returns.—The Consolidated Mining & Smelting Co. is handling about 35,000 tons per month, producing \$351,000, of which rather more than half is gold. The Granby and B. C. Copper smelters were partly shut-down last month, the former owing to a breakage of mine machinery, and the latter through shortage of coke due to bad weather conditions. The cost of copper production was thus increased to 10c. per lb. at the Granby and to 11'59c. at the B. C. Copper plant. The Granby people have, however, reduced the cost of mining and smelting to \$2'39 per ton, the lowest record in the company's history.

Mining Institute.—The Western branch of the Canadian Mining Institute held a meeting at Nanaimo last month at which the U. S. Geological Survey was represented by E. W. Parker, the matter of principal interest being a paper by F. Napier Dennison, of the staff of the Dominion Meteorological Department, conveying results of original research conducted with a view to proving an intimacy between earth disturbances and coal mine disasters. Mr. Dennison illustrated his argument by diagrams prepared from the movements of pendulums that he had established at the Western Fuel Co.'s mine at Nanaimo, one instrument being at the surface and the other in the mine at a point 979 ft. below sea-level. The readings of these instruments had been taken twice daily over an extended period, and they showed that the ground had an extended swing easterly and westerly in alternation. He contended that the results showed that when the swing reached toward the limit earthquakes were common occurrences, and simultaneously with these earth strains and consequent liberation of gases, the great coal-mine disasters of the world had occurred. The conclusion, he argued, was that by the use of these instruments, which were of his own design, in the coal-mining regions, the management of mines would be apprised of the approach of such critical periods and could take precautions to safe-

guard the lives of the miners. As a result of Mr. Dennison's work the organizations devoted to scientific research and the B. C. Board of Trade have passed resolutions recommending the Dominion Government to provide facilities and erect stations to prosecute this research work.

NEW YORK.

The stock market has not been in so stagnant a condition since July 1908. The reason for the phenomenally low prices of mining stocks, as of other shares, is to be found in a general unsettlement pending a decision from the Supreme Court on the Standard Oil and the Tobacco Company's cases. It was confidently predicted that the decisions would be handed down on March 20, but the Court took a recess until April 3 without disposing of them. The principles underlying these two cases are fundamental in the conduct of innumerable other corporations throughout the country, and investors naturally do not wish to commit themselves to undertakings the very legality of which may later be questioned. The Supreme Court did, however, remove a portion of the uncertainty by upholding the constitutionality of the Corporation Tax law, and the routine machinery for collecting this tax has already been put into operation.

Listing of mining shares on the New York Stock Exchange is on the increase, and is an encouraging indication of a growing confidence in the integrity of the industry. Ray Consolidated and Chino Copper are the latest shares to be transferred from the Curb to the Exchange. The Curb brokers rather resent the loss of their profits in these shares, but the rules of their new organization, just completed, forbid any further dealing in them.

Calumet & Hecla consolidation is practically assured by the favourable action of the stockholders of the several mines concerned. The smaller companies, having the most to gain, voted unanimously for the consolidation, while the bigger and more self-reliant mines, notably the Osceola, indicated some opposition, in no cases however, amounting to more than a small percentage of the voting stock.

Licensing of engineers was proposed in two Bills introduced in the New York State legislature. By adopting the ancient definition of civil engineer, the Acts were intended to apply to every variety of engineer except military. An examining board was to be created, which would issue licenses to engineers only upon proof of their training and

experience for a required number of years, and upon payment of a substantial fee. Opposition by the several technical societies in New York City was prompt and unanimous. It then transpired at a public hearing, at which the societies were strongly represented, that the Bills had no very creditable authorship, and they were then practically abandoned by their official sponsors.

ores at North Tincroft. The magnetic concentrator has been tested under the supervision of the makers of the plant. The working generally has given satisfaction, but experiments will have to be tried over a more extended period before the best results are obtained. Two parcels already sold at the ticketing leave no doubt as to the superiority of the magnetically treated ore.



Part of Michigan showing the position of the Copper and Hecla Mines.

CAMBORNE.

Boswin. — The equipment at this little mine at Wendron is nearing completion and crushing should shortly be commenced. The dressing plant consists of a pair of Holman air-cushion stamps, Wilfley tables, Record and Frue vanners, and a Campbell gas engine and producer plant supplies the power. The shaft is now down over 60 fm. and it is reported that the ore blocked out is equal to about two years' supply for the present mill, a quantity which is rather unusual in a Cornish tin mine.

Carn Brea & Tincroft.—The new dressing plant at Carn Brea for dealing with the purer ores from Carn Brea and South Tincroft are practically completed, and arrangements are also ready for classifying the more complex

ores at North Tincroft. The magnetic concentrator has been tested under the supervision of the makers of the plant. The working generally has given satisfaction, but experiments will have to be tried over a more extended period before the best results are obtained. Two parcels already sold at the ticketing leave no doubt as to the superiority of the magnetically treated ore.

Basset Mines. — In what must have been an unguarded moment—perhaps it was after the hearty lunch that usually follows a mine meeting in Cornwall—Capt. James (the manager of this property) informed the shareholders that more than one-half of the decrease of 145 tons in black tin production last year was due to the product being dressed to a higher grade. Naturally this has set the experts thinking, because a substantial increase in the price secured would be needed to offset not only this large reduction in weight, but the increased expense entailed by the extra cleaning. From the records of the London and West Country Chamber of Mines I find that the increase in price received over the previous year was roughly £18, and of this probably two-thirds was accounted for by the higher market price ruling, leaving the balance as the result of the extra dressing. Thus it would appear that the 700 tons produced fetched some £4200 more than it would have if the previous standard of dressing had been maintained; while on the other hand the decrease in the weight alone of say even only 72 tons at £81 per ton, the price the black tin would have fetched had the old standard prevailed, or £5832, much more than balances that gain, quite apart from the extra cost involved. So that it would appear that the new departure was hardly a financial success. Of course it may be that owing to the reduction in the grade of ore milled (about 6 lb. per ton) some slight increase in cost would have been involved in keeping up the former percentage of dressed product, but only the mine authorities would be able to supply this information. In any case it is abundantly clear that the question is one requiring careful thought, and

it constitutes a departure from the rule of thumb methods usually in vogue in Cornish mining works.

Botallack. It is satisfactory to know that this property is to have a further chance of proving what it is thought by most Cornishmen to be one of the best speculations in the country. The old company has been reconstructed with the heavy liability of 15s. per share, but fifty thousand shares have been guaranteed so the new company is certain to start with what should prove ample funds to complete Allen's shaft to a depth of 205 fms. and unwater the old mine, even after allowing for the payment of the old company's liabilities and the costs of the new issue. This work is estimated by the consulting engineers, Pettit & Poore, to cost at least £27,000. Merricks, Crane & Co. are the new general managers.

Tresavean Mine.—The water in this old copper mine has now been drained to a little over 200 fm. below adit, the slow progress being due to the very bad condition of the pump shaft. It is reported that the results of the explorations in the upper levels have been satisfactory, which is more than can be said in the case of some of the other old mines that are being drained at the present time.

West Kitty.—This mine has once more reached the producing stage and the first sale of black tin was made at the tin ticketing early this month. The property continues to be vigorously developed and I understand that a lode of fair grade is being opened up in the bottom of the Wheal Friendly section. It appears that owing to trouble over the old leases the properties have not yet been transferred to the new owners, although they have been in actual possession for more than 12 months and have spent a considerable sum on their development. This matter may according to the solicitor of the old company take only a few weeks to satisfactorily arrange, or it may take years, but anyhow it is most unfortunate for the shareholders in the old cost book company, who have paid heavy calls to clear off their liabilities, and now cannot get the stock of the new company.

Falmouth Consolidated.—From a report by F. Dietzsch recently made public, it appears that these mines have been in fork for some little time and that recent developments prove that the former workers entirely missed the main or foot-wall part of the lode, although this same part of the lode had been extensively worked above adit. Four cross-cuts have been driven, covering a total distance of 80 fm. along the strike of the lode, which has proved

to be of an average width of about 8 ft., with an assay value of 30 lb. black tin per ton. To deal with this large piece of stoping ground, on the recommendation of Mr. Dietzsch, the directors have decided to double the present Californian battery of 20 heads.

MEXICO.

The Insurrection.—Up to this time the Federal troops have made little headway against the revolutionists in Chihuahua, and the situation in that State has been serious for some time. For weeks the Mexican Central railroad between Chihuahua and El Paso has been out of commission, due to the destruction of track and bridges, and traffic on the Mexican Northwestern railway has been repeatedly interrupted. There have been traffic interruptions also on the Kansas City, Mexico & Orient railroad, and on the Yaqui River line of the Southern Pacific in Sonora. Engagements between Federal troops and revolutionists have occurred in Sonora, Lower California and Durango, as well as in Chihuahua. There has been some activity in the southern part of the Republic, but so far the Government has been able to prevent serious trouble. Brigandage has developed in several parts of the country. Mining in Chihuahua has suffered to some extent, and while the larger concerns in the western districts have continued to operate, the obtaining of supplies, and the safe shipment of pay-roll money and bullion, has become a serious problem. For a time the revolutionists threatened Juarez and appeared to have that gateway at their mercy, but later they withdrew, allowing Federal forces to enter the border town. The *insurrectos* are operating without general direction or systematic plans, and dissension among the leaders has been reported recently. Local questions enter extensively into the troubles in Chihuahua. The total taxable wealth of the State is estimated at 100,000,000 pesos, and the holdings of Gen. Luis Terrazas are estimated to represent fully 60,000,000 pesos. It is stated that he has never paid in taxes to exceed 15,000 pesos per annum. Terrazas opposed Diaz in the days when the Mexican executive was fighting for control of the Government, and when the latter gained power a truce was effected, under the terms of which Terrazas practically agreed to keep peace in Chihuahua in return for being "let alone." After the present trouble started Diaz gave the Terrazas interests every opportunity to assist in restoring order by making Alberto Terrazas, the eldest son, governor of that State, but they

failed to make any headway, and Col. Miguel Ahumada, the retiring governor of Jalisco, and formerly for a number of years governor of Chihuahua, was sent to succeed Terrazas. In a recent interview, given out in Paris, José Yves Limantour, the Minister of Finance stated that reforms were necessary, and advocated, among other things, the abolishment of the feudal system and the cutting up of the great estates of the Republic. It is the general understanding in Mexico that a num-

ber of changes in the official family of President Diaz are pending. The United States has increased its forces along the border in an effort to stop the shipment of arms and ammunition to the Mexican revolutionists. Some Mexicans of prominence express the belief that the revolutionists have received financial aid from the Standard Oil Co. They profess to believe that the aid was given in retaliation for the concessions granted the Pearson oil interests, and the fight conducted by those interests on the Waters Pierce Oil Co., the Standard concern in Mexico, which formerly controlled the Mexican field. Guil-

ermo Landa y Escandon, governor of the Federal District, is president of the Mexican Eagle Oil Co., the Pearson marketing concern, and Enrique C. Creel, Minister of Foreign Affairs, and Major Porfirio Diaz, son of the President, are members of the directorate of that company.

Peñoles.—This mining and smelting company, the most important in which German money is interested in Mexico, has increased its capital from 4,000,000 to 6,000,000 pesos.



GUADALUPE

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The original capital of the company was 250,000 pesos, and it was formerly controlled in Mexico City. The control passed to German capitalists several years ago. The company has been operating in the Mapimi district of Durango for a number of years. Last year it purchased control of the San Juan Mining Co., another important Mapimi concern, the transaction involving cash and securities to the amount of several million pesos. The present smelting plant consists of six 150-ton blast-furnaces, 4 revolving Huntington-Heberlein roasting-furnaces, 2 reverberatories, and an arsenic plant. The company

is the largest producer of arsenic in Mexico. Some other interesting is done.

English Railroad.—The Mexican Union Railway Co., the English concern that last year acquired the mineral railroad extending from Torres, a station on the Sonora railway (Southern Pacific), to Represo, is now engaged in the construction of an extension to Ures, a Sonora town of importance, and the centre of a rich mineral district. The extension will be 70 kilometres long. The English interests plan to build later to a connection with the Yaqui River line of the Southern Pacific.

WASHINGTON.

Congress has adjourned and the country has heaved a responsive sigh of relief. There are always so many things Congress may do that business men are glad to know what changes are and what are not to be made. In this case the relief from suspense will be short since a special session has been called and will be at work before this reaches the reader. The last session of Congress was notable mainly for the losses sustained by 'the old guard' as the ultra-conservative element of the Republican party is nicknamed. In the new Congress the Democrats will control the House and the Progressive Republicans will be able to throw control in the Senate to the Democrats or to the old-line Republicans as best suits their purpose. The significance of this is that the newer ideas as to tariff, conservation, and public lands seem likely to make rapid headway. The Congress which has just adjourned created the Bureau of Mines, authorized Presidential withdrawals of public land, separated surface from mineral rights in coal lands, and revised the tariff. The country never forgave it for the Payne-Aldrich tariff bill, and so there are many new faces in Washington. It is believed that the new Congress will pass the Canadian reciprocity bill, revise the tariff again, and probably take up seriously the framing of a law providing for leasing the public lands. The latter will be of especial interest to mining men.

Secretary of Interior.—At last there is a new man at the head of the Department of Interior, R. A. Ballinger having finally resigned and retired to private life. The general sentiment is that he meant well but was a small man in a large place and was much encumbered by old-fashioned notions. Walter L. Fisher, who succeeds him, comes from Chicago, from the same city and even the same ward that is already represented by two members of the Cabinet. He is a young man, a lawyer

who has established an enviable reputation for ability and character. He is best known for having acted as attorney for the City in negotiating the famous settlement of the traction muddle and, indeed, this settlement was due mainly to his keen analysis of the situation and power as a negotiator. He has been a leader in the conservation movement, but is judicial in his attitude and well qualified to handle the Alaska coal cases and other vexatious problems left unsolved by his predecessor.

Appropriations for the work of the Geological Survey and the Bureau of Mines remain practically where they were last year. Since the Bureau of Mines will not need so much money for equipment this year as it did in 1910, the effect is a welcome increase. Doubtless active investigations in Western metal mines will now begin. The good work done by the Geological Survey in Alaska was recognized by Congress and the allotment increased by \$100,000. A. H. Brooks, the energetic chief of that division has now, therefore, the same allotment that was given to Clarence King when he organized the Survey itself. Among new items is an appropriation of \$20,000 to the Geological Survey for "determining geological conditions favourable to the presence of deposits of potash salts." A small appropriation was also made to the Bureau of Soils for potash investigations. This action of Congress has been stimulated by the difficulties with Germany over the potash situation and it is hoped either that deposits of potash salts may be found by drilling, or a process of leaching the material from rocks containing potash, developed. As is well known, Germany has practically a monopoly on potash and there are necessarily large imports into the United States. Americans have complained bitterly over the Government regulations governing the production of potash salts in Germany. Some years ago certain Boston men, foreseeing trouble and actuated by patriotic motives, as well as hope of gain, spent considerable money in investigating the saline deposits of the Western deserts in hopes of finding a supply of potash. They were not successful. Whether the Director of the Geological Survey will do better remains to be seen. If not, the United States can still trade phosphate (of which this country contains large reserves) for potash, without, it is to be hoped, too much friction in the process.

Mexican troubles, and the movement of troops to the Rio Grande, naturally have attracted much attention here. In general the belief is

that the President took advantage of the occasion to give the officer of the army and militia some needed practice in handling large bodies of troops and, incidentally, to allow the General Staff an opportunity to show off. It is hoped that inquisitive foreigners will note the efficiency of the present organization. Aside from this it is supposed that the troops are to stop filibustering and strengthen the hands of the Mexican government in that way. Incidentally if intervention by anyone prove necessary, they will be fully equipped and ready. It is believed that the Mexicans will be able to handle their own matters satisfactorily, though there can be no doubt that the insurrection has lasted longer than was anticipated. The main trouble has been in Chihuahua and mines have been affected mainly in that transportation has been interrupted. Confidence in a speedy return to peaceful conditions is evident in that the price of Mexican securities has held firm and a number of shrewd and experienced buyers of mining properties have left the United States for Mexico within the last few days.

SAN FRANCISCO.

Oil-men in California are well satisfied with the action of Congress in relieving them from the effects of the Yard decision. There is still some doubt as to whether the first or second withdrawal will be held to mark the close of free prospecting and also as to what constitutes the "inception of work" from which rights of claimants must date. Determination of these matters will soon be made but in the meantime the new legislation removes a cloud from title to over 100,000 acres directly affected. How serious the situation was has not been fully appreciated. With imperfect titles it was impossible to attract outside capital to complete development and yet if the latter stopped all rights against the Government ceased. To add to the troubles of the oil-men a few 'gushers' made a surplus of oil and broke the price. If relief had not come when it did there would have been many bad failures. As it stands the situation is good. While there is a surplus of about 38,000,000 bbl. in the hands of pipe-line companies, this amount is not excessive in view of the large consumption and the decrease in rate of production that may occur at any time. That this is true is shown by the fact that despite this surplus, producers are holding out for better prices. If no new gushers appear they are likely to win. An interesting proposal has been made to a number of oil operators at Bakersfield by a corporation that proposes to

collect the casing-head gas and compress it to form gasoline. The process is in operation in Eastern oilfields, and is said to yield gasoline of especially high grade. That it should be proposed here, indicates that the old days of unlimited waste are coming to an end.

Prospects.—Nevada, as is well known, has been prospected from end to end since the discovery of rich ore at Tonopah and Goldfield attracted renewed attention to the sage-brush State. Among the resulting discoveries was one near Fairview. The prospect fell into the hands of George Wingfield and his associates and steady development has made of it a good mine, the Nevada-Wonder. A 3-compartment shaft is now being sunk, and a milling plant, designed by J. B. Fleming, built. The two vein-systems will be opened by crosscuts from the 600-ft. level in the new shaft and



A Mining Camp in Nevada

ore will be hoisted in 2-ton skips to the top of the mill. The latter includes a crusher, automatic weighers, 20 stamps of 1250-lb. weight, concentrating tables, and tube-mills. Concentration will be followed by cyanidation. The process will involve continuous agitation, decantation, filtration, and precipitation by means of zinc-dust. The new plant is well designed and excellently built, steel and concrete being extensively used. It is expected that it will be in operation by June 10.

Utah mine operators, and indeed their fellows throughout the West, were much pleased at the recent announcement made by E. P. Mathewson, to the effect that the International Smelting & Refining Co. is planning to build lead furnaces at Tooele. As is generally known the American Smelting & Refining Co. and affiliated Guggenheim concerns, have had almost a monopoly of the lead business for some years. The Holden interests, through the United States Smelting, Refining & Mining

Co., broke into the field some years since, followed later by the Ohio & Colorado Co., which operates a plant at Salida, Colorado. Neither of these concerns, however, has been a large buyer of castmotes, depending mainly, as was indeed necessary, on mines owned by affiliated companies. The International smelter is owned by the Cole-Ryan group. It was built to smelt copper ore, especially that from the Utah Consolidated mine. Mr. Mathewson has now got the copper furnaces running smoothly and an incursion into the lead business is to be the second step toward general competition. Lead mining in Utah, Nevada, and southern Idaho, will be stimulated by this move. In recent years the Cœur d'Alene and Missouri have entirely dominated the lead-mining industry, and the known but undeveloped resources of the Great Basin have been neglected.

The Camp Bird mine, according to recent announcement at Denver, now has better prospects than were anticipated, diamond-drill exploration having resulted in the discovery of high-grade ore. An orebody 12 ft. thick was recently found 200 ft. west of the present workings in what is said to be the Coronado vein. Between this ore and the surface, there is from 900 to 1300 ft. of ground. The opportune character of the strike is shown by the fact that for a year or more, according to the last annual report, the workings advanced into new territory had revealed no orebodies of importance. The development on the main lodes had added approximately \$1,000,000 to the net value of the reserve, but so far as high-grade ore was concerned there seemed to be an end. The conditions were similar to those existing when the present company secured the mine under option from the late Thos. F. Walsh. Since then the mine has earned approximately \$12,000,000 net, and apparently, from the discovery just reported, there is reason to expect that the life of the Camp Bird will be further extended.

Colorado.—Extensive development is in progress on several large mines near the Camp Bird in the Sneffels district. About 180 men are employed in the Revenue mine and mill. Most of the new work is on the Montana vein, which promises to rival the Virginus. By summer the Atlas will have a connection completed between the main workings and the San Pedro, and will be in a position to employ a large number of men and to make a production to correspond. An entirely satisfactory treatment for Atlas ore has been worked out in the 10-stamp mill now in operation, and

the milling capacity can be increased as fast as warranted by the production. On the Bright Diamond, near the town of Ouray, the Wanakah company has opened another of the caves like those in the American Nettie—caves with floors covered to a depth of several feet with high-grade oxidized ore. The Wanakah mill is operating continuously on ore from the main workings.

In the Red Mountain country, a rich find is reported at the Barstow. The George Crawford companies, which control about three miles of ground between Red Mountain and Ironton, are to be re-organized with a reduced capitalization, preliminary to a resumption of operations on a large scale. The principal Crawford companies are the Gold Lion, the Blue Bell, and the Red Mountain. Among the well known properties which they own are the Joker adit, the Genessee-Vanderbilt, and the Yankee Girl. The latter, under lease, is now making regular shipments. It has produced millions. New development has been carried to a point where it will be profitable to put a large number of men on production in a number of the Crawford properties. Work is to start by May 15 or June 1, with H. Y. Russell in charge. The Guadalupe Mines Co. expects to have 50 men at work and to be shipping at least 50 tons daily by July 1, and by that time also the Mono-Baltic company will have 150 men employed in its smelter and mines. Taken all together, the outlook for increased activity at Red Mountain promises to place it again among the most productive districts of the San Juan.

Mine inspection by State officers is universal in the coal-mining regions, but inadequately developed in the Western metal mines. In California there is no State inspector, and while the men have made repeated requests for the establishment of an office of State mine inspectors, operators have always succeeded in defeating the Bill. This year an Act providing a system of inspection passed the House and may pass the Senate. There is a growing feeling that inspection is warranted and in the end would be of benefit to operators as well as miners. It is known that the State laws are being violated at a number of mines and there is no adequate means for enforcing them. The fear of the operators, and one for which there is much justification, has been that incompetent inspectors would be appointed for political reasons. There is a general feeling that the present Governor will appoint good men, if given the opportunity, and if some means of assuring good

appointments in the future can be found, the Bill will probably pass.

Nevada mining men had their attention called sharply to the ever present danger of fire in mines, by the disaster at the Tonopah-Belmont on February 23. This mine is one of the most important properties in the State. It has paid nearly a million dollars in dividends, has a rapidly growing surplus, an excellent plant, and has been managed with unusual success. The equipment is up to the best standards of Western American practice and its mine officials are men of experience and ability. Despite all these facts a fire on the 1160-ft. level resulted in the death of 17 men, although it burned but a few hours and did but little damage to the mine itself. Apparently the fire originated from a burning

Help was sent from the neighbouring mines and about noon on the following Saturday the mine was recovered. The coroner's jury blames the management for "lack of knowledge and experience in such emergencies, and also inability to foresee and realize that serious danger might result from such a fire." The fact is being realized, however, that exactly the same accident might have happened at any time at many if not most Western mines. The fault lies in a general lack of appreciation of the extreme danger incident to fire underground and the necessity of having at each mine definite plans for fighting a fire at any point. Mine-managers unfortunately have not been in the habit of studying their workings from this point of view, as the officers of a fire department study the buildings in a city. If the Bel-



EAST BELMONT SHAFT OF THE TONOPAH-BELMONT MINE.

candle left on or near timbers at the foot of a slope connecting the 1160, 1100, and 100-ft. levels. It was reported by one of the mine watchmen at 6 a.m. before the day-shift went to work. The seriousness of the danger apparently was not recognized and a large number of men went into the shaft as usual. Some were sent to the surface and others remained to fight the fire. Much confusion seems to have prevailed and eventually a number of men were overcome by smoke and killed. Others, including the superintendent and foreman, barely escaped. Among those killed were several rescuers who made repeated trips down the shaft to drag out the exhausted fire-fighters. It was the usual story of thrilling heroism, following the equally usual unpreparedness.

mont disaster leads to more serious work in this direction good will have come out of evil.

Mine-rescue cars are now maintained by the United States Bureau of Mines at various points. These are fully equipped with apparatus and trained men for service in case of accidents. One such car in charge of Sumner S. Smith, a California mining engineer, was rushed to Tonopah at the time of the Belmont accident, but having to come from Wyoming, did not arrive until after the fire was extinguished and the bodies recovered. Mr. Smith has since been giving lectures and demonstrations of rescue and first-aid work at Tonopah, Goldfield, and in other mining centres in Nevada. This is the first extension to the metal mines of the work that has been carried on

Let training in the coal-mining districts. The general purpose of these cars is not only to be of service directly in case of accident, but to serve as means for a general campaign of education. Good results have already become apparent. A number of the larger coal-mining companies have equipped cars and stations of their own, and gradually a force of men is being trained prepared to meet every emergency. In Illinois the State has taken hold of the work and built both training stations and cars. It is now proposed that Nevada shall equip a car and keep it at Sparks or some other central point subject to call.

JOHANNESBURG.

Struggling Companies.—During the present wave of depression the disappointments readily get magnified and the successes ignored. For example, the failures of the Van Dyk and the Cloverfield mines have been represented to exert far too weighty an influence on the destiny of the Far East Rand. The depressing features are outweighed by the results of the New Modderfontein, Modderfontein B, and Brakpan mines. Glancing through the record of results for February, I note the substantial profits made by some of the struggling mines: Lancaster West, £5532; Aurora West, £3012; New Rietfontein, £3192; Lui-paardsvlei Estate, £3314; Geduld, £3674. These give cause for satisfaction, apt to be neglected in these times.

Single Shift.—In his note in favour of the single-shift system, appearing in *The Mining Magazine* of February 1911, C. Baring Horwood makes out a strong case, but does not amply represent the difficulties to be faced in abolishing the night shift. Everyone will agree with Mr. Horwood that better work is done in stopes handled exclusively by one man, yet the broad claim for a reduction of 6d. to 1s. per ton mined calls for more definite substantiation. The additional stopes required by no means comprise the limit of liabilities. Indeed, there are many mines working on double-shift in which individual stopes are worked on single-shift by one miner, and the benefits outlined are similarly attained. One of the most important problems to be faced—though not in the mines of the Randfontein group with which Mr. Horwood was associated and which are run almost exclusively with hand labour—is the extra demand for air-power. It is the prevalent complaint of most resident engineers that their compressors are over-taxed, even when the call for air is distributed over two shifts. Further, the capacity of shafts

and station has to be a factor of weight, to be carefully considered before it can be declared that the single-shift system is economical. When a mine is comfortably working on the single-shift system, having ample shaft and compressor capacity and stope-faces available, and when, say, 40,000 tons per month is being milled for a profit of 10s. 6d. per ton against a previous 10s., our thoughts might well be turned not to a complacent satisfaction of comforts attained, but to the probable feasibility of increasing that tonnage to 60,000 tons and those profits from £21,000 to £30,000 by the revival of the double-shift.

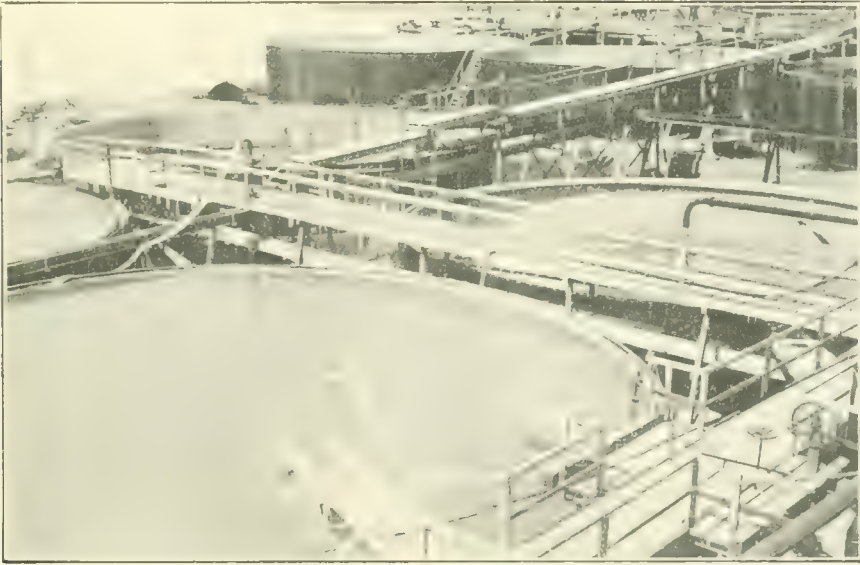
The advantages of the single shift, which are admitted by all to be real, though not necessarily overwhelming, are emphasized by W. Moses, Inspector of Mines for the Johannesburg district, in his recent annual report. He lays stress upon the greater safety of operations attained under the arrangement.

Premier Diamond.—The eighth annual meeting of the Premier Diamond Mining Co. was held in Johannesburg on February 28, under the chairmanship of A. Wagner. To the technical man or the investor, no meeting could have been more unsatisfying. The old wrangle with De Beers has been given a temporary rest and, in its place, shareholders have been given, not a detailed discussion of the mining or industrial position, but a further outburst of irritation against the 60% profit tax. It is a generally admitted fact that just as this was an equitable tax at the time of its introduction (allowing, as it did, the £1 share in the company to reach £70 in value), so is it today an excessively onerous one, when the yield per load has fallen to so small a figure. At the same time, the matter is no secret and must be perfectly well recognized by the authorities in whose hands questions of taxation lie. With the company's chairman, Sir Thos. Cullinan a power in the reigning government, it is surely unnecessary to raise this popular clamour at an annual meeting, so well fitted for a detailed statement of the company's mining and commercial affairs. Does Mr. Wagner expect Johannesburg to rise in a tempest of wrath and threaten revolution until the burden of taxation is transferred from the Premier company to their own backs? If such public sympathy is desired, the chairman should be more logical in his criticisms. The 60% tax was introduced in 1903 when the profit-making capacity of the Premier mine was dazzling in its magnitude and when the company received vast returns in proportion to outlay on plant and expenditure on operations.

Later, the grade fell and big outputs and expensive machinery became essential to success. Then, gradually, the burden of the tax became excessive, as it is today. With obvious motives, the introducers of the original tax are covered with ridicule and abuse, while the Government of the last few years, though it has failed to repeal or amend the tax, is mentioned with expressions of nauseating friendship. For the present Government is strong. Public support to a just cause is only weakened by such oleaginous methods.

Circular Shafts.—The Western Rand Estates, the pioneers of circular shaft-sinking since the War, have re-started work on Gembokfontein, south of Randfontein. A great

working on many levels simultaneously. But it certainly appears reasonable to conclude that Mr. Williams' paper was only intended to give facts regarding Kimberley methods and to suggest the possibilities of their application, in modified form, to the mining of new Rand areas. If a mine is today hoisting ore from 12 levels, it is a foregone conclusion that the upper three are fairly well exhausted and that the middle six are too far advanced to warrant any change of development plan, while perhaps the bottom three levels will form part of a centralization scheme introduced for the exploitation of the deeper areas. My complaint with Mr. Schmitt's cold-water criticism does not lie in his emphasizing the difficulties of



SLIME PITS AT NEW RANDFONTEIN

thickness of dolomite has to be penetrated, and the probability of encountering water in troublesome quantity is a factor governing the methods adopted. The shaft will be tubbed with cast-iron segments until the danger zone has been passed.

Development in Depth.—In a discussion of Mr. Alpheus Williams' paper on the Kimberley system of rock-handling, C. O. Schmitt of the Consolidated Gold Fields pointed out some of the difficulties of applying schemes of centralization, of concentrated hoisting, to Rand mining. The fact that the rapid and cheap hoisting of big tonnages is best effected when operating on one or two levels only is well known; as also the fact that the majority of Rand mines are generally

establishing mechanical haulage-ways in existing workings, but rather in his raising the particularly dangerous argument that a regular decrease in grade is a factor of vital importance. Although experts with the vast accumulation of evidence possessed by the Corner House have failed to formulate any decided theory of zonal distribution of gold or of gradual impoverishment (neglecting surface enrichment) Mr. Schmitt rashly suggested to the meeting of the South African Institute of Engineers that, with a value of 40s. at 1000 ft., 30s. at 2000 ft., 25s. at 3000 ft., and 22s. 6d. at 4000 ft. (figures given from memory), the Rand grade would be—Heaven knows what—at 5000 ft. It would be fruitless to re-state the arguments for and against the theory of a

gradual decrease of grade in depth, except to point out that nothing so daring as the scale of assay-values, almost casually propounded by Mr. Schmitt, has before been given at a technical meeting. The practical question is whether even assuming poorer values, the system of main haulage-levels and concentrated hoisting cannot be advantageously adopted. Granting pay-ore, the only difference making the requirements of ground rated at 32s. 6d. and 22s. 6d. would be the occurrence of a greater proportion of unprofitable blocks in the latter case. The grade would, however, necessitate the introduction of big-scale mining, and probably preclude the success of a selective policy. If the area is reasonably undisturbed and can be worked without loss by the ordinary means of levels in ore with hand-tramming and independent bins, it would require arguments, to disprove the economic advisability of mechanical haulage-levels and chutes serving intermediate drifts, that would hold no less strongly in the case of Mr. Schmitt's 40s. or 30s. horizons.

Contract v. Bonus.—It is satisfactory to find that the important question between contract and day's pay plus bonus has been taken up seriously by the Mine Managers' Association. The proposal, to be submitted to further investigation and discussion, is for the introduction of a system of payment based on a guaranteed minimum day's wage plus a small contract or bonus, as opposed to the flat contract system. In the annual report of the Association, it is remarked: "The former (system) would turn out, it was felt, to the mutual advantage of both employer and employee, and would ensure the employee coming out with something to his credit at the end of the month's work, instead, as not infrequently happened where the flat contract system was in vogue, of his coming out in debt to the company. . . ." There is no question but that the scheme of a minimum day's wage has much to its advantage. There must, however, be concerted action, or the companies that do not come into line—that retain the present flat contract system—will attract many of the best miners. The scheme, argue as you may, is a levelling one. It helps the mediocre men and it hits the fathom-per-machine-shift men. If the wages account is not to increase, the money that guarantees the indifferent contractor his 15s. or 20s. per shift comes off the earnings of the man now able to make a sure £3 per shift. It is nevertheless good policy in the long run to effect this averaging. Let the first-rate miner work with

more consideration to the enduring health of himself and his 'boys,' and let the less skilful man be given this extra encouragement and the assurance of a steady wage for conscientious work. But the necessity for common action in a matter of this kind cannot be too strongly emphasized.

MELBOURNE.

Broken Hill.—The past week has seen the issue of several important balance-sheets. These include the Broken Hill Proprietary, the South Broken Hill, and the North Broken Hill. In the wide range of Australian mining there are not six properties to compare in importance with these three. The South today is the champion claim of the Barrier silver field. Into it pitches the great ore-shoot that was first opened by the Proprietary company, then by the Block 10, next by the Central (Sulphide Corporation), and last of all by the South itself. In the Proprietary the orebody near the surface was 300 ft. wide. In the South at 1170 ft. a diamond-drill has just proved it to be 110 ft. wide carrying 20·8% lead, 10·8% zinc, and 4·1 oz. silver per ton. This assay, of course, only comes from the whole core and there is nothing published to show what is the worth of the ore for every 5 ft. of core. Still that the 110 ft. should have assayed so well is a matter of great importance to the company. As the managing director, F. C. Howard, says, the mine so far has never "failed to respond to the requirements of the company." At the 1070 ft. level doubt was expressed as to the behaviour of the orebody. At that level, although just touched, 200,000 tons of ore is proved already. The manager's estimate is that each level will yield 1,000,000 tons of ore, and there is every promise of that estimate being realized at 1070 ft. One fact has to be stated: As was the case at the Block 10 mine, the deeper ore is closer grained, more intimately associated mechanically with the gangue. This change in the case of the Block 10 mine meant fine grinding, lower recovery of the lead and silver, and the sliming of the ore. Now science, through the agency of the Minerals Separation process, has provided a means whereby the slime can be treated successfully so that the loss in that direction is minimized. The South company, however, has contracted to deliver its output to the Amalgamated Zinc Company for the next nine years. Whether that company can treat the slime as well as the Minerals Separation is yet to be demonstrated. So far as the North goes there is nothing more to be said than that it is piling

up profits. Its general manager, George Weir, has just made a record in the matter of working cost, having reduced his 3s. per ton below that of the South mine. The physical characteristics of the ore at the two mines favours the North, but the personality of Mr. Weir has a good deal to do with his achievement. At the Proprietary the feature today is the better position of the company to handle its ore cheaply and the progress made with its zinc-smelting plant. The whole of the 10 furnaces are now ready and the management re-asserts that the cost of treating the zinc concentrate is below the estimate, that difficulties have been less than were expected, that the clay serves admirably (some of the retorts being in use for 95 days), and that the company has been able to train the Australian worker to carry out his duties most efficiently. The chairman, John Darling, holds out the hope that the future is much brighter than for years past. It is the intention of this company to try and capture the spelter trade of the East just as they have a big hold upon the lead trade there.

New South Wales.—The mineral output of New South Wales during 1910 was of the value of £8,736,469, an increase of £100,776 and, with the exception of 1907, when the price of minerals went to the highest point touched, the total has never before been reached. The number of persons engaged in the industry was 37,413 and the value of the plant and machinery in use was stated roughly at £6,156,000. This means that for every £1 of plant in use over £1. 5s. of mineral was obtained. To the end of last year the mineral production of New South Wales reached the total of £208,119,529. The output of coal was 8,173,508 tons, valued at £3,009,656. The quantity of coke made was 282,337 tons, valued at £189,069. The kerosene shale amounted to 68,293 tons, worth £33,896. Silver-lead mines yielded products to the value of £3,399,674, an increase of £518,706 on the previous year. Copper production was valued at £486,257, an increase of £61,520. The value of tin and tin-ore production was £228,156, an increase of £17,127. While this is a pleasant picture, the unrest at

Newcastle threatens to affect the output of that coalfield seriously. Already large bodies of men complain that they cannot get work. Undoubtedly the establishment of the Victorian State coal mine has cut into the New South Wales coal output. The workers have been cursing capital and preaching the nationalization of the industry. Now that they have a taste of the real thing they object to the weight of State competition. This result has opened their eyes, far wider than any amount of preaching. Lessons such as this will come as time passes unless some change in spirit develops among the Labour leaders. At Ballarat the other day one of them went so far as to declare that 'profit' is an iniquity. If the Ballarat district be taken as an example, it has been kept alive for years by the profits earned in other industries being applied to promote local mining. The apostles of Socialism keep that fact in the background.



Brown Coal.—Melbourne has within a few miles of its doors one of the most remarkable deposits of brown coal in the world. The measures have been bored for over 1000 ft. and have given over 750 ft. of workable coal. In the past the State has had many reports upon these deposits and has had tests made by briquetting firms in Germany. The reports are satisfactory, the average composition being as follows

	ANALYSIS		ANALYSIS
Carbon.....	67.60	...	68.36
Hydrogen	5.33	...	4.56
Oxygen	22.78	...	22.16
Sulphur	0.27	...	0.57
Ash.....	2.57	...	4.35

In the case of the Victorian product the water is 21% and in that of the Austrian brown coal 12%. It is safe to say there are hundreds of millions of tons of brown coal in Victoria, but all of it is lying idle despite its potentialities. One of the reasons why it has not been briquetted is the absence of a cheap and satisfactory binder. Another is the large initial outlay that will be involved to provide plant, and still another the doubt as to the policy of the country in respect to the nationalization of industries. However, a move is at last being made to turn the deposits to account. The idea is to make producer-gas, probably by the Mond system, and to generate electricity for the supply of power to Melbourne. It is said that large profits can be earned by retailing electricity a half-penny per unit. To test the matter German scientists are on the way to Australia. The obstacles to be overcome by any new enterprise are great. First of all the State, having tasted Socialism in its ownership of the State coal mine at Powlett, may refuse to allow any owners of the brown-coal deposits to come into competition with them by carrying through a huge electrical scheme. Then the Metropolitan Gas Co. will be in the field in opposition and the Melbourne City Council will not want to have its electric-power works reduced to the value of scrap-iron. Even if all opposition be disarmed, it is inevitable that conditions will be imposed which will give to the State the right to take over the venture or will limit the profits that can go to shareholders. Public opinion is all in this direction and the capitalist who is prepared to invest must not shirk that position. It is deplorable on economic grounds that the fad of State Socialism should fetter industry. The brown-coal deposits should be worked to provide cheap fuel and cheap power. If private capital can be persuaded to turn coal to account it is flying in the face of progress to check the enterprise.

Bullfinch.—A sensation was caused in Australian mining circles by the step taken by the West Australian Government in issuing warrants for the arrest of E. W. Bonwick, E. C. Dyason, and Harold Greenway, mining engineers, on the charge of conspiracy to defraud the public in connection with reports issued on the Great Chaffinch mine at Southern Cross. The clause of the criminal code under which the warrants were issued provides that "any person who conspires by direct or any fraudulent means to affect the market price of anything publicly sold, or to defraud the public, or any person, whether a

particular person or not, is liable to seven years' imprisonment with hard labour." The accusation seems to be that these men sent disparaging reports of the claim, doing so at a time when the market price of shares was buoyant, and causing a fall in price. The Chaffinch lease was secured in October last by John Arthur of Adelaide under option on behalf of the Kookynie Options Syndicate. Mr. Arthur, who was appointed local director, reported the discovery of rich ore in a trench. Some doubt being expressed, he invited a party of Pressmen to drive out with him and inspect for themselves. Mr. Arthur then set to work with the pick and broke down about a foot of ground. The pick struck something solid and out came lode-matter described in one journal as glistening with the precious metal and worth about 100 oz. to the ton. The vein was reported to be a small one at the opening of the trench and was understood to have widened to a foot in the bottom. The Pressmen were so impressed that they signed a certificate stating what they had seen and giving a high opinion of the value of the claim. A few days later Harold Greenway then took charge. On opening up the trench he sent a telegram saying that the full width of the lode was 2 ft. containing a rich streak of gold ore about 2 in. wide. Next Mr. Greenway reported he had sampled the formation over a width of 3 ft. and the 'stone' had only averaged 12 dwt. per ton. Later reports showed about 2 dwt. per ton. Mr. Greenway then suggested that an expert engineer should report on the property, and the Adelaide Stock Exchange and the company appealed to the West Australian Government to send a representative. This, however, the Government would not do, but suggested that a member of a well known firm of mining engineers should make the inspection. C. F. DeJ. Grut was appointed and his opinion pretty closely bore out that of Mr. Greenway. Several conflicting reports were received from different people in the locality. Shortly after this Mr. Greenway asked for some change in the control of the company, and this not being granted he resigned his position as manager. The public fails to see what grounds exist for the charge against these three men. Nothing has been reported to indicate that the opinions expressed by them have been unwarranted, and the present prospects of the claim are below zero. [A cablegram in *The Financial Times* of April 4 states that the action in the Chaffinch case has been dismissed, the magistrate expressing the opinion that the accused acted honestly.]

PERSONAL

W. H. ALDRIDGE has opened an office at Los Angeles, California.

R. S. BOTSFORD has been appointed manager of the Aurora mine for the Brazilian Goldfields, Limited.

E. H. BRANDT is on his way to Chihuahua, Mexico.

R. GILMAN BROWN has been appointed consulting engineer to the Kyshtim Corporation.

T. LANE CARTER is in Jalisco, Mexico.

DONALD CLARK has been appointed Chief Inspector of Technical Education in Victoria.

W. H. CORBOULD is general manager of the Mount Elliott mine, Queensland.

RICHARD DAVEY is at Bogoslovsk, Russia.

THEODORE DWIGHT is now a partner in the firm of Catlin & Powell, brokers, at New York.

NORMAN R. FISHER, manager of the Temiskaming mine, Cobalt, is in London.

WILLIAM FRECHEVILLE left for Johannesburg on April 1.

ANDRE P. GRIFFITHS has been appointed consulting engineer to the Mexico Mines of El Oro.

W. T. HALLIMOND has resigned his position as manager of the Rose Deep and is taking a holiday in England.

H. C. HOOVER has returned from New York.

J. IRVINE JAMESON has resigned his position as manager of the Rooiberg Tin Mines, in the Transvaal, and is taking a holiday on the Continent.

H. EWER JONES remains the consulting engineer to the Rhodesian Exploration & Development Co.

ALEXANDER W. KEAN has arrived from the Gold Coast on a holiday.

G. C. KLUG is now directing operations at the Great Fitzroy mine, Queensland.

ERNST LICHTENBERG is in Austria.

F. W. LINCK is examining hematite mines in northern Lancashire.

GERALD LOVELL, recently manager for the Burma Mines, has arrived in London, on his way to Montreal, where he will take charge of an office for Bewick, Moreing & Co.

J. H. MACKENZIE is in Nicaragua.

E. A. MANNHEIM has left for Brazil.

W. A. MERCER has returned from Angola, in Southeast Africa.

MERRICKS, CRANE & CO. have been

appointed managers of the Botallack mine in Cornwall.

GEORGE V. MICHELL is expected in London from West Africa.

A. LEGGETT NEALE, for many years manager of the Transvaal Gold Mining Estates, has resigned his position owing to ill-health.

H. E. NICHOLLS is on his way to Nigeria, having been appointed manager for the Jos Tin Area.

R. A. F. PENROSE is at Paris.

H. A. PIPER is not consulting engineer to the Rhodesia Exploration Co.; he has simply arranged to inspect a few mines belonging to that company on behalf of the Consolidated Gold Fields of South Africa.

C. W. PURINGTON has returned from Siberia.

C. M. ROLKER is examining copper mines in the Ural mountains.

J. D. AUDLEY SMITH left Sydney for New Caledonia on January 25.

HENRY SOMERVILLE has been appointed assayer to the Kapsan mines, in Korea.

J. E. SPURR is examining the Camp Bird mine in Colorado.

WALTER STANFORD has been engaged as consulting engineer to the Ivanitzky mines, in Central Siberia, on behalf of the Russian Gold Corporation.

A. W. STOCKETT, manager of the Simmer & Jack, has been elected president of the Association of Mine Managers of the Transvaal.

HENRY F. STRANGWAYS is on his way to Cerro de Pasco, Peru.

J. W. H. STUBBS has been appointed technical advisor to the General Mining & Finance Corporation.

EDGAR TAYLOR was recently in Spain.

W. F. A. THOMAE is in Siam. He expects to return in July.

C. S. THOMSON, consulting engineer to the Neumann group, is spending a holiday in Europe and America.

W. E. THORNE is in Brazil.

MORTON WEBBER has left New York for Porcupine.

E. A. WEINBERG is not consulting engineer to the Mount Elliott company, although he was formerly connected with it. His office is at Melbourne.

LEWIS T. WRIGHT is in Mexico.

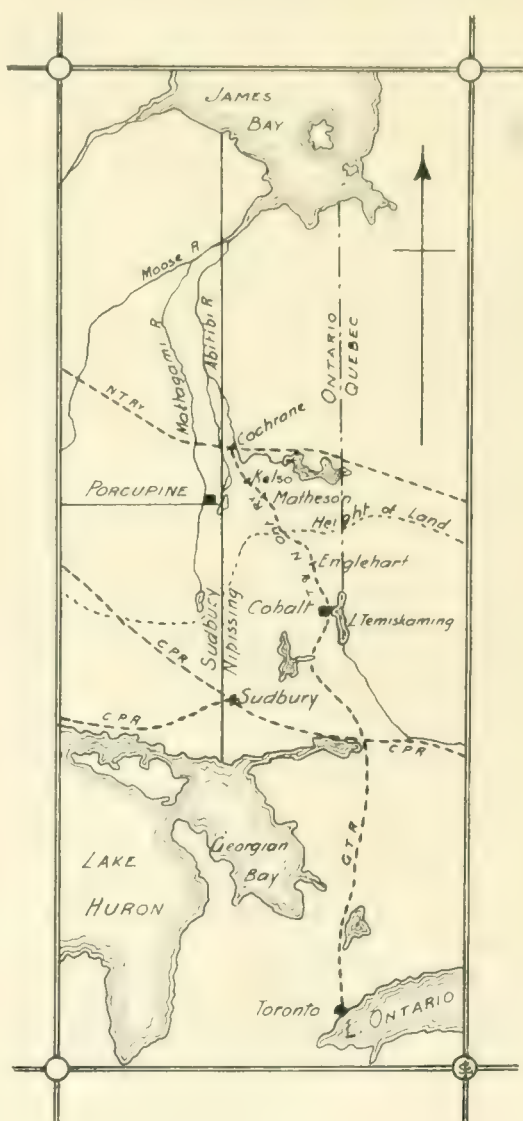
THE PORCUPINE GOLDFIELD

By W. J. LORING.

TO some readers of your valuable magazine it may appear unnecessary to give some of the following details concerning the Porcupine goldfield, in Northern Ontario, but to those who have heard little of this important discovery it is hoped these notes will be of interest.

This mineral discovery was made by men of much courage, but lacking experience of gold mining, the predominant metal mining industry in Ontario until recently having been based on lodes of silver ore, notably at Cobalt. Following the discovery at Porcupine, mining engineers from all parts of the world visited the locality, as well as men representing investors of capital. Free gold was visible in many of the outcrops, and this stimulated the discoverers to demand absurd prices for claims upon which no development work had been done. Some of the more daring capitalists purchased the more promising claims, in several instances making large cash deposits, carrying obligations to follow these at short intervals with substantial payments. In one instance the cash deposit was \$50,000, the balance of \$300,000 being payable by instalments over a period of five months. This was not all. At the date of the discovery there was no road to the goldfield, except by canoe through rivers and lakes, and by foot, during the summer, but in the winter this means of transport and travel was stopped by snow and ice. It was therefore necessary to survey a winter road from mile-post No. 222 (north of North Bay) to Porcupine, through a wooded country, advantage being taken of the frozen rivers and lakes wherever possible. Even allowing for this kind of cheap road-making, the cost of clearing the trees for a road over the land portions proved very expensive, but this was taken in hand by the purchasers of the claims referred to above, thereby making it possible to transport mining supplies and passengers from the railway to Porcupine by sleigh. The road was completed before anything of a permanent nature could be done toward testing any of the prospects. Much credit, therefore, is due to those who were responsible for the construction of the road, namely, the Timmins-McMartin-Dunlap syndicate, and M. J. O'Brien, before much was known as to the value of the prospects.

This new goldfield has now been made comparatively easy of access. The route from Toronto is by the Grand Trunk railway, northward 226 miles to North Bay, where connect-



tion is made with the Temiskaming & Northern Ontario railway, which runs north to Cochrane (about 500 miles from Toronto), where the Government line connects with the new trans-continental system being constructed across

the northern part of the Dominion. The point to which passengers must book is called Kelso, a new station 448 miles north of Toronto and 222 miles north of North Bay. The great silver-mining centre of Cobalt is passed on the way from North Bay to Kelso. The Temiskaming & Northern Ontario railway's branch-line from Kelso to Porcupine, now under construction, is anticipated to reach Porcupine about July next. Since the discovery of gold in the summer of 1909, the mile-post at 222, now called Kelso, has been

and passengers have been able to reach the field by canoe and by foot between the waterways, whereby the distance is lengthened by fully 80 miles.

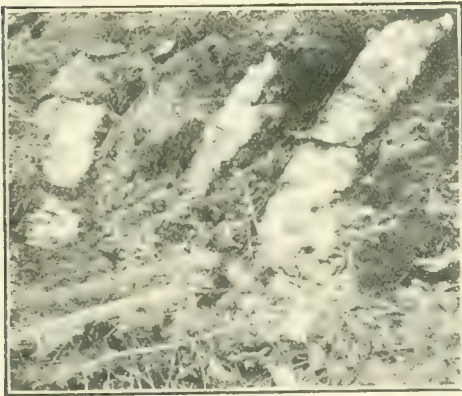
It is said that the population of Porcupine and the immediate district comprises from 3000 to 5000 people. Small towns have sprung up in the district; these are principally built of logs, but quite comfortable. During the first winter, namely, that of 1909, nothing of a serious character was started, apart from building log-houses just sufficient to house the



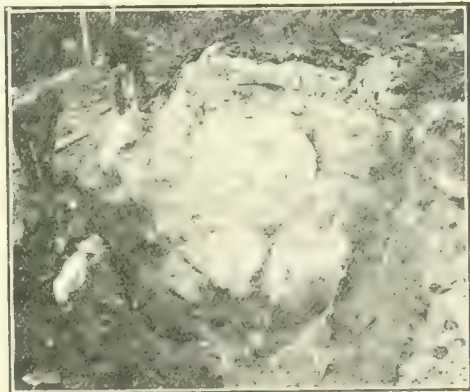
Crossing a Sand Bar.



On Porcupine Lake.



Veins in the Schist.



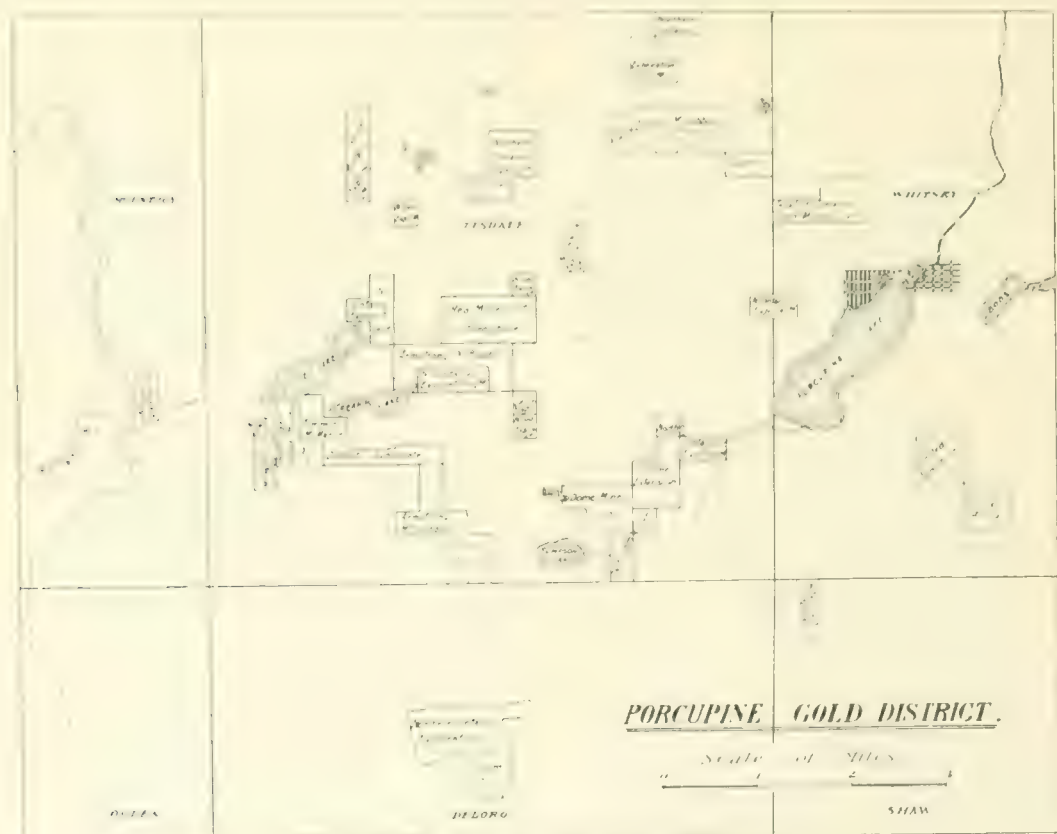
Examining an Outcrop.

the winter station at which supplies and passengers for Porcupine have left the railway to be transported by sleigh, if provided with the necessary cash to pay for this means of transport, or if not, the distance of about 40 miles has to be travelled on foot or by toboggan drawn by dogs. This road is much shorter than the summer road, as rivers and lakes, being frozen over, can be used for a roadway during winter, thus shortening the distance by some 40 miles. In summer, only light goods

men who were engaged in prospecting. However, during that time, enough prospecting was done to prove the district to contain a promising series of veins. Prior to this, however, the country for miles had been pegged out by prospectors, who placed fabulous prices on their holdings. At the same time, men with capital and much courage came forward, and purchased a number of the more promising claims by paying large cash deposits before any real development work had been done.

hearing that my friends of the discovery of a new goldfield in Canada, I decided, after discussing the project with my partners, at once to proceed to Porcupine. I arrived in the locality on December 23, 1909, being one of the first engineers to reach the goldfield. At that date M. J. O'Brien, the Timmins syndicate, the Dome syndicate, and another company or two were doing actual development work. In no case had more than mere surface prospecting been accomplished, therefore it was quite impossible to form anything better

to be mined in depth. Since the date of my visit the district has been again inspected by one of my confreres, during the summer of 1910, when the country was free from ice and snow, and a better geological examination was possible. During the interval between my visit and that of the engineer referred to above, a considerable amount of development work had been done in the shape of shaft-sinking on a number of the mining claims, among them being the Hollinger and the Dome mines. At the Hollinger the main shaft had been sunk to



MAP SHOWING SOME OF THE PRINCIPAL LEASES

than a general opinion as to the future of the district, although outcrops of quartz, some of which contained visible gold and pyrite, could be seen in various places. The ore thus exposed did not show much indication of oxidation, therefore there could be no chance of secondary enrichment, and the future determination of the treatment of the ore promised to be much less troublesome than would be the case if the outcrops were oxidized. It might also be inferred that the outcrops should represent the general value and character of the ore

100 ft., and a considerable amount of driving had opened up a vein 6 to 8 ft. wide, a portion of the ore from which was being treated in a 3-stamp mill, and it was stated that the recovery was about $2\frac{1}{2}$ oz. per ton. Some diamond-drilling had also been done on the Dome mine, proving that the orebody continued to a depth of at least 400 ft., where extremely high assays are reported to have been obtained.

Since then the developments on several of the leases have been conducted so far as to prove beyond doubt that high-grade ore does



The Dome Mines.



One of the Dome Shuts.



A Prospecting Trench.



The Dome Outcrop.

persist to a considerable depth, as well as for a great length. The main shaft on the Hollinger property has now reached a depth of 200 ft., where the drift is in high-grade ore. Simultaneously with the development at depth, the 100 ft. level has been driven to nearly 1500 ft. in length, exposing ore 5 to 7 ft. wide, the assays reported corresponding to those mentioned above, obtained when the level was first opened. A cross-cut has now been put out to a distance of about 140 ft. from the main vein. The first 28 ft. of the schistose wall-rock immediately adjoining the main vein apparently ranges in value from 6 to 16 dwt. per ton. At about 140 ft. a parallel vein has been intersected, 5 to 6 ft. wide, and where the cross-cut passed through it, the average value is said to be 4 oz. 4 dwt. per ton. Development work is being pushed at this point with all possible speed, and it can readily be seen that it enhances the value of this particular property very much indeed. It also proves that the schistose wall-rock immediately surrounding the Hollinger main vein constitutes pay-ore, that the Hollinger main vein is not the only orebody confined within the Hollinger property, and that there are at least two veins in this property carrying profitable ore. During the present winter season an enormous amount of freight has been transported over the roads to the Porcupine district, among this material being a number of prospecting outfits, consisting of boilers, engines, compressors, and other mining supplies, and it is reported that orders have been placed for several up-to-date stamp-mills, one of which is to be erected adjacent to the Hollinger mine, and another on the Dome property. The Consolidated Gold Fields of South Africa is also conducting extensive development operations on properties recently acquired by that company. Viewing the situation from a broad point of view, it is fair to conclude that Porcupine is an important gold-field, and that a number of highly profitable gold mines will be opened up in the near future.

The following is a record of the leases held in the various townships, up to March 17, 1910:

Township	Number of Claims
Whitney	550
Tisdale	550
Mountjoy	170
Shaw	450
Temiskaming Forest Reserve...	680
Godfrey	240
Total.....	2640

The total area covers about 105,600 acres.

The town of Porcupine is in the Whitney division, while the Hollinger group of mines is in Tisdale, as shown on the accompanying map.

Important interests in the Porcupine field have recently been acquired by the Northern Ontario Exploration Co., which was formed in London in January last, with a capital of £400,000, in 400,000 shares of £1 each. On the formation of this company, Charles Algeron Moreing, the senior partner in the firm of Bewick, Moreing & Co., together with a number of engineers, proceeded to Canada for the purpose of acquiring, if possible, attractive mining properties in the Porcupine district, for and on behalf of the Northern Ontario Exploration Co. As a result, a half-interest in 50 mining claims has been purchased from the Timmins-McMartin-Dunlap syndicate. These leases are favourably situated in the most likely portions of the goldfield, and some of them surround the Hollinger mine. Already a considerable amount of machinery and mining stores have been despatched to the scene of operations, and a vigorous campaign of development work is now in hand on behalf of the Northern Ontario Exploration Co. Considering the large auriferous area of the district, the indications are very favourable indeed for the opening up of a number of productive claims. It is well known at the present time that a continuation of the Hollinger vein system traverses the district for a long distance, showing gold in various places. These indications are as favourable as those obtaining at the Hollinger and Dome properties during my visit, late in 1909.

The Hollinger vein system lies parallel to the Dome series, both being easily traced for a considerable distance through the district. These two known lodes are $3\frac{1}{2}$ miles apart and strike through the country northeastward. No doubt other parallel veins exist, and will be found when development work on a large scale is begun. Looking at the position from a broad point of view, I expect that, instead of the veins being worked 6 to 8 ft. wide, for \$40 or \$50 per ton, the stoping-width will be nearer 20 ft. for an average of \$20 or \$25 ore. At any rate, the discovery of schistose rock (which forms the walls of the Hollinger) containing pay-ore for a width of 20 ft., induces me to believe that the mines will be capable of producing much larger tonnages than has been supposed, once they are developed. Hydro-electric power will be available shortly from a distance of 8 to 10 miles; this should reduce the cost of working, thereby making it possible to mine and mill at a handsome profit ore containing \$4 per ton.

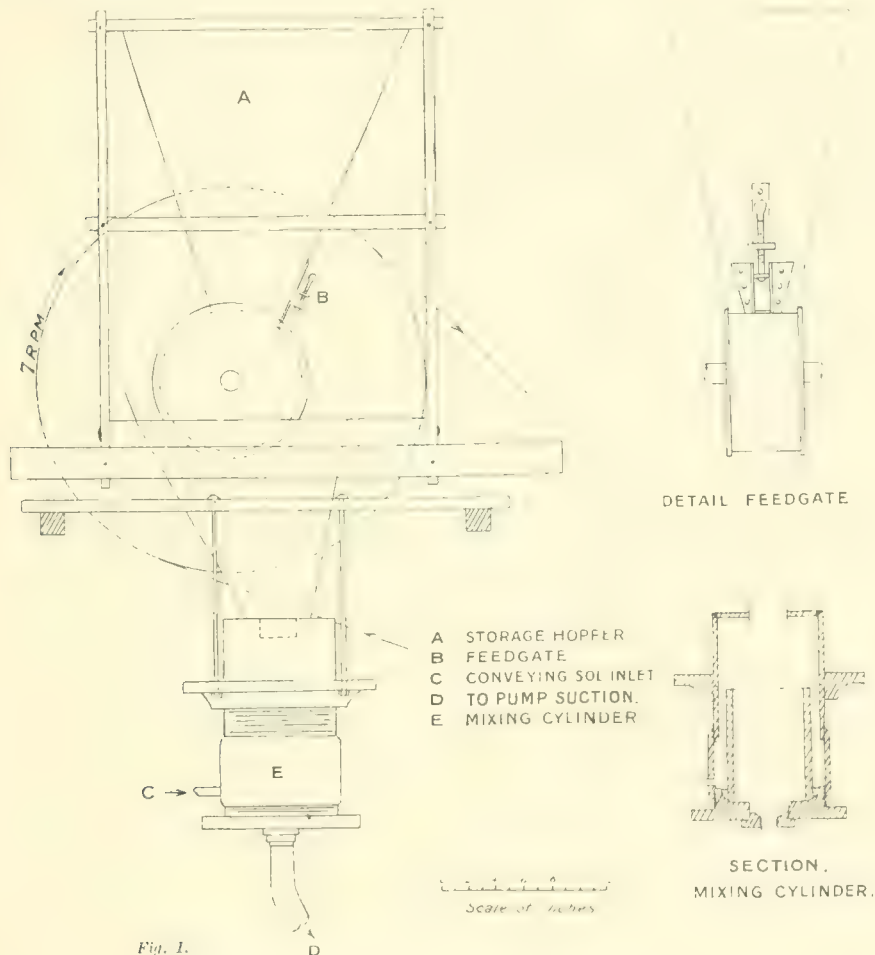
ZINC-DUST PRECIPITATION

By ALLAN J. CLARK.

IN previous discussions concerning the precipitation of gold and silver from cyanide solutions by the use of zinc-dust, emphasis has been placed upon the importance of preventing oxidation, both of the zinc-dust before it is used as a precipitant and of the mixture

works solution, may be brought about in several ways, among which may be noted the following:

1. By agitating, with compressed air, the solution before precipitation of the precious metal.



of dust and precipitate while still retained in the press.

This point has been properly emphasized, but a further adverse influence that may be exerted upon the operation by undue exposure to air has not been sufficiently appreciated. This, the formation of calcium carbonate by reaction of the carbonic acid carried by the air with the calcium oxide dissolved in the

2. By agitating, with compressed air, the mixture of zinc-dust and barren solution in the mixing cone.

Further, when the water-supply is drawn from a limestone formation, the substitution of water for barren solution in the mixing cone will result in the precipitation of calcium carbonate, even though no air be used in the process of mixing, the calcium oxide of the

TABLE I.

Plant No.	Description of Press	Concentration of solution		
		Pounds per Ton of precipitate.	Pounds per Ton of solution.	Pounds per Oz. of gold.
A.	100 Square Section Frame 4in. deep Inlet at bottom.	16750	0.14	1.39
	112 Triangular wooden blocks placed in lower corners, to approximate triangular section.	18500	0.218	1.4
	100 Square Section Frames 4in. deep Inlet at bottom.	15800	0.26	2.27
	100	16400*	0.31*	2.2*
	162	20600	0.215	1.69
C.	100 Triangular Section Frames 2in. deep. Inlet at bottom.	23070	0.19	1.49
	100	35960	0.15	1.38
B.	117 Same as Group B.	13900	0.226	1.59

* Same as Group A, but that other procedure was used throughout.

solution reacting with the bicarbonate contained in the water.

At the time when my attention was first engaged by this question, the Homestake plants were operating with precipitation presses of various design, including some of the modern Merrill presses and some of square section, of the common plate and distance-frame type. The zinc-dust was introduced by the Merrill method of delivering the zinc emulsion at the

base of the suction column of the pump, the contact of zinc and pregnant solution taking place during the elevation of the solution to the presses.

The zinc was in all cases mixed in an inverted cone, to which a small stream of barren works solution was added, while a brisk agitation was maintained with compressed air, the emulsion passing through an outlet pipe placed near the rim of the cone, to mix with the preg-

TABLE II

Plant No. 1: Press of Square Section (same as Table I., Group D) used throughout.

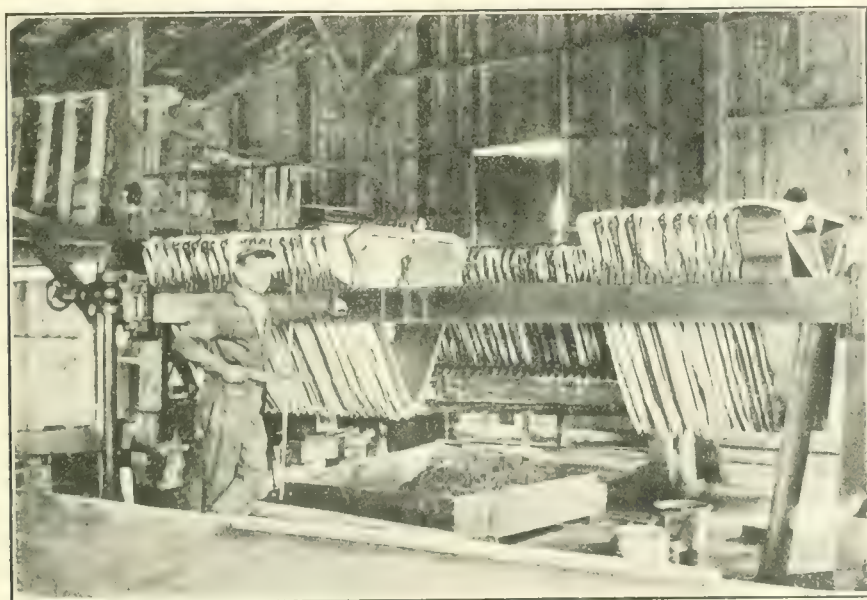
Period	Method of Preparing and Introducing the Zinc Dust	Concentration of solution	Zinc in solution	
			Pounds per Ton solution precipitated	Pounds per Oz. Gold recovered
Aug. - Sept.	Belt to cone (mixing with air and solution) to pump suction	13,100	0.228	1.4
Oct. - Nov.	Emulsion made in a revolving barrel, discharging to cone (mixing with air and solution) to pump suction	16,200	0.216	1.4
	Belt to trough to pump suction	26,400	0.139	1.03

nant solution as pumped. The dry zinc was fed to this cone either from an endless belt, driven by a float from the vat being pumped, or it was simply introduced to the cone at intervals of about half an hour, in portions to correspond to the feeding interval maintained.

The first instance of the effect of calcium carbonate was noted while precipitating a very weak and low-grade solution of relatively high alkalinity. This solution, being collected in shallow vats and agitated with compressed air before beginning precipitation, was in a condition particularly favourable to the formation

more formed on the sides of the launders carrying the barren solution discharged from the press.

By eliminating the preliminary agitation of the pregnant solution these precipitation troubles ended at this point, but a theory of the influence of calcium carbonate suggested itself: namely, that the efficiency of the zinc is diminished by the precipitation of carbonate, which, gathering about the particles of zinc as nuclei, shuts them off from further action, and that this deposition is slower than the reaction of gold with zinc.



THE MERRILL PRECIPITATION-PRESS

of the objectionable carbonate. The zinc, in this instance, was fed from a belt to the mixing cone, and the precipitate was collected in a Merrill press. The precipitation offering some difficulty, the rate of flow to the press was reduced, in the expectation of thus increasing the efficiency of the operation, but the precipitation was in no way improved, while on opening the press a heavy deposit of calcium carbonate was found, sometimes caked hard upon the press-cloths, sometimes mixed with the precipitate, and in one instance forming a layer of soft butter-like matter, resting above the mass of precipitate, and covering the cloths to a thickness of about half an inch.

An increase of the rate of flow to a point higher than previously carried was attended by better results, and the deposit of carbonate within the press decreased in quantity, while

This theory was investigated by reference to past records, a tabulation of which, together with a few later results, is given in Table I.

The influence of the shape of the press upon the grade of precipitate and the consumption of zinc, suggested by a comparison of Groups A, B, and C, was carried further by removing the wooden blocks from the Group A presses, thus changing them from an approximately triangular to a square section. These results, which are tabulated as Group D, afford, when compared with Group A, a better indication of the influence due to shape, inasmuch as the solutions precipitated at the three plants of the company are of decidedly diverse character. In this connection, however, it should be noted that the solution precipitated at the No. 1 Plant (Group A) was stronger in cyanide and richer in gold content than that precipitated at

the No. 5 Plant (Group C), and hence might reasonably be expected to consume less zinc per unit of gold recovered.

Attempts to attain faster filtration by pumping at regulation speed through only half of the usual press equipment gave negative results, the efficiency of zinc and grade of precipitate being less when a resistance was developed in the press. This result was invariably noted under such conditions, but the exigencies of treatment necessitated certain adjustments that prevented a careful estimate of the extent of this decrease in efficiency.

Our methods were now generally modified to conform to these conclusions, but the air agitation in the mixing cone was continued and the extent of its harmful effect not realized until some time later, when experiment in another field drew attention to the possibility of further improvement in this direction. The mixing cones were then eliminated from the system, the zinc being allowed to fall from the endless belt into a trough, whence it was washed by a stream of solution direct to the precipitation line, with no further mixing.

The results achieved during the first month while operating in this manner are presented in Table II, with the results under the old system during the months immediately preceding the change.

The gain indicated by the new system may be summarised as follows:

Increase in concentration: 63%.

Decreased consumption of zinc per ton of solution: 35%.

Decreased consumption of zinc per ounce of gold precipitated: 38%.

During the past year Colbath* and Yaeger† have described new feeders for which improved efficiency was claimed. The former discharges zinc from his feeder into a hopper or trough, where it meets a measured quantity of the pregnant solution and is carried direct to the pump-suction, while the latter effects a further mixing in a miniature tube-mill and considers this formation of an emulsion as essential. It is noteworthy that in each instance agitation with air has been omitted, and to this I believe the improved efficiency should be attributed, rather than to the deficiencies of the belt-feeder. Indeed, that feeder may be quite as efficient as those described in the articles cited, as both of them, from the nature of their driving mechanism, are of intermittent action, and the tube-mill appendix of Yaeger's may be interpreted as a recognition of this fact.

Recognising, however, that the belt-feeder is irregular in its action, observation showing the zinc-dust to fall from it in portions of unequal volume, and at intervals of from less than one second to more than fifteen seconds, and considering it probable that this irregularity would be emphasised by the removal of the mixing cone which formerly served to partly equalise the feed, a continuous feeder was devised and installed for trial at the No. 2 Plant.

This feeder, the design of foreman W. H. Todd, is illustrated herewith. It is driven by a belt, from the pump-shaft, and the discharged zinc is carried by a small stream of solution to the pump-section, no air being used to assist in the mixing. It operates steadily and requires little attention. Results from the first month's operating with this feeder, compared with those under the old system of belt-feeder and agitation of the discharged zinc with solution and air, were as follows:

Increase in concentration: 80%.

Decreased consumption of zinc, per ton of solution: 33%.

Decreased consumption of zinc, per ounce of gold precipitated: 31%.

These results are in general accord with those given in Table II, and warrant the statement that a reasonably regular supply of zinc is sufficient for all practical purposes when, as is usually the case, the zinc and solution travel some distance together before entering the press.

Canadian Mineral Production.—The Canadian Department of Mines has issued a preliminary summary of the mineral production during 1910. The yield of gold was valued at \$10,224,910, an increase of \$842,680 over 1909, and that of silver 31,983,328 oz., an increase of 4,453,855 oz. The production of copper was 25,267 tons compared with 23,435 tons, of nickel 16,638 tons as compared with 11,733 tons, and of pig iron 800,797 tons as compared with 757,162 tons. Of the pig iron approximately 85% was made from imported ore. All the above yields show an increase for 1910. On the other hand the production of lead has been considerably reduced, being only 14,718 tons as compared with 20,472 tons in 1909. The chief fall was in the Slocan district where forest fires have destroyed mine buildings and railways. The production of coal increased from 10,501,475 tons to 12,796,512 tons, and asbestos showed an advance from 87,300 tons to 100,385 tons.

**Engineering and Mining Journal, February, 1911.
†Mining and Smelting, December, 1910.*

MINING COPPER ORE WITH STEAM-SHOVELS

By LEROY A. PALMER.

BINGHAM, the scene of the Utah Copper Co.'s mining operations, contains the first mineral location in Utah; it was the first organized mining district in the State, and the Utah Copper Co. was the first successfully to treat low-grade 'porphyry' ores on a commercial basis, and the first to use steam-shovels for mining copper ore in the Western hemisphere. The town and the mine lie 25 miles southwest of Salt Lake City in Bingham canyon, a narrow cleft in the Oquirrh mountains, which form the western border of the Salt Lake valley. It is connected with Salt Lake by a branch of the Denver and Rio Grande railway and with Garfield, the site of the Utah Copper Co.'s two mills, and the Garfield smelter, by another branch of the Rio Grande. Transport to Garfield will be improved by the completion, about June 1911, of the Bingham & Garfield Railroad, a subsidiary of the Utah Copper Co. The camp has passed through many changes of fortune, the valuable metals sought being, at various stages, silver, lead, gold, and copper, but it did not enter upon its greatest prosperity until the value of the immense low-grade deposits of copper ore was demonstrated.

The geological formation is similar to that of the other regions in which the deposits of disseminated copper are found, such as Nevada, Arizona, and New Mexico. The structure of the district is a shallow syncline pitching northwest. The sedimentary rocks are of Carboniferous age, most of them of the Upper period. Already the most important is the Bingham quartzite which has a thickness of about 10,000 ft., as far as exposed. In this quartzite are lenticular masses of limestone; these are not persistent, but owing to their lenticular shape vary rapidly in thickness and often disappear altogether. The contact is usually clean-cut, the limestone changing to quartzite in a few inches; but occasionally the change is more gradual through calcareous sandstone or silicious limestone.

In the Tertiary period long after the deposition of these sediments, two volcanic eruptions occurred. One was an intrusion of monzonite and the other an outpouring of andesite, with its accompanying tuffs and breccias. The latter happened after the mountain range was in its present form, and appears to have been

subjected to comparatively little erosion. It lies around the base of the mountains toward the Salt Lake valley, and does not appear to have had any effect on the ore deposition. On the other hand, the monzonite, which covers the greatest area next to the quartzite, seems to have been an active agent in the deposition of the ore. It forms many irregular bodies, most of which are connected at the top and may be connected at great depth. It is intruded into the sedimentaries, often forming



thin sheets along the bedding planes; but the most important body is a great laccolith of irregular outline lying between the main canyon and a branch known as Carr Fork. While some of the ore accompanying the monzonite was doubtless formed by contact metamorphism the intrusion was instrumental in the deposition of ore chiefly by shattering the mass into which it was erupted and by being itself shattered in the process, thereby allowing a free circulation to the ascending solutions which carried the mineral and deposited it in the cracks of the rocks. The Bingham laccolith, or Utah Copper Hill, as it is locally known, is mineralized by fine grains of pyrite, chalcopyrite, and a little bornite and chalc-

city minerals iron being strongest where the rock has been subjected to the greatest crushing and alteration. Across this laccolith is a strong fissure, the Quinn, with a north-east strike and a dip of 42° to 65° northwest. This fissure is supposed to be the channel of mineralization. The ore is covered by an oxidized cap which has been leached to such an extent as to make it unprofitable to work. The average thickness of this cap is about 70 ft., representing that much dead work that must be done before the extraction of ore can be commenced. It is estimated that 115,000 cu. yd. of cap is removed per acre and that 1,000,000 tons of ore is exposed. Assuming that the cap weighs two tons per yard, like the Ely deposit, which is practically identical, this means that 230,000 tons of cap is removed per acre or one ton to every $4\frac{1}{3}$ tons of ore. The cost of stripping during the year 1909 was 35.2 cents per yard, or, allowing for all expense, such as railway construction and dumping rights, 53.1 cents. The great elevation of the upper portion of the deposit has made necessary the construction of narrow-gauge tracks for the handling of material, this being the item represented as railway construction.

The Utah Copper Co. owns 580 acres of ground, a large portion of it on the laccolith. This ground was first exploited by underground methods but these were abandoned for steam-shovels when the extent of the deposit was satisfactorily proved. At present this company has 24 steam-shovels, so that allowing for those laid up for repairs an average of 20 is in continual operation.

From the lowest point in the canyon where the monzonite is found as part of the Bingham laccolith to the highest point is a vertical distance of 1850 ft. This is divided into 22 benches on most of which the work of stripping or extraction of ore is in progress. The upper portion of the hill was formerly the property of the Boston Consolidated Mining Co. Work was started here by steam-shovels but abandoned for underground methods so as to gain depth on the orebody. When this ground was acquired in January 1910 by the Utah Copper Co. the latter decided to go back to steam-shovel methods, and several machines were put at work stripping the ground to put it in shape for this method of extraction. At present operations on this portion are confined to stripping.

Churn-drills are used for both prospecting and mining. Four of these drills are Star and the others Keystone, six being used for each class of work. While the monzonite is

a comparatively soft rock the shattered condition makes it hard to get a good core and therefore core-drills are not satisfactory. The bits used vary from 4 to 12 inches, 6 in. bits being used for the blasting-holes. The Star drills, which are the heavier of the two used, have 16 hp. engines with 8 by 8 in. cylinders and an adjustable crank, usually run with an 18 in. stroke. The weight of the tool on the Star drills is 2000 lb., on the Keystones only about half as much. Two men are employed to a drill, an engineer and a driller, and one of the heavier machines will drill 15 to 25 ft. in a 10-hour shift.

For blasting, the holes are put down 8 ft. lower than the bank, with a burden varied to suit the height of the bank and the nature of the ground, 30 to 35 ft. at the bottom being a fair average. Each hole is cased to a depth of 20 ft. in starting and if the sides show a tendency to crumble the casing is extended the full depth. When a hole is completed it is sprung with 35% dynamite and when a round is ready it is fired with a battery. The seamy and uneven nature of the monzonite gives the drill a tendency to drift and this causes the hole to break with a wide toe. These holes are trimmed by putting in a round with a piston drill and firing by hand with 35% dynamite.

The lowest bench, which is above the portion called the 'pit,' is 240 ft. high. The remaining benches are at intervals of 75 ft., except some started by the Boston Consolidated which have a height of 60 ft. The bench above the pit is all in ore, which is of uniform grade so that it can be worked to a greater height than is customary. The holes are put down 30 to 90 ft. with a 6 in. bit and fired as noted above. Two shovels are engaged continuously in loading ore in the pit. They handle the ore broken down from the high bench and also some from the upper levels. On account of the steep hillside it is not advisable to run continuous standard-gauge tracks, by which the ore can be hauled to the railroad; instead on the upper levels it is loaded into small dump-cars and hauled to a chute by which it is transferred to the lower level and rehandled by the shovels in the pit. The dump-cars used in this work are the standard type of steel two-way dump with a capacity of 12 yd. The shovels used are two Bucyrus (Model 95), two American, two Marion (Model 60, with $2\frac{1}{2}$ cu. yd. dippers), the remainder being Marion Model 91, with $3\frac{1}{2}$ cu. yd. dippers. Fifteen seconds is required to load and dump a dipper when there are no interruptions.



STEAM-SHOVEL BENCHES OF THE UTAH COPPER MINE.

The shovels in ore work two 10-hr. shafts, illumination at night being furnished by three powerful searchlights set on the opposite side of the canyon. The spur track from the pit leads to the railroad by which the ore is hauled to the mills.

The cap material is loaded into small cars and hauled to the different dump-sites. The canyon is so utilized by various industries that it was impossible to obtain any single site or any two or three sites that would afford sufficient room for the immense tonnage of waste handled. The acquisition of the Boston Consolidated brought with it a side hill on which the benches were 800 ft. above Carr Fork with a slope such that most of the waste from the Boston ground can be deposited here with only a short haul. But on the other side of the mountain, in the original Utah Copper ground, facilities were not so good and several small dump-sites were acquired. One of these was Copper Center gulch which was occupied by the buildings and adit of the Bingham Mines Co. This was purchased outright; the Bingham Mines Co. moved its buildings away and commenced extending one of their other adits through which to operate, and the Utah Copper Co. filled the gulch in short order.

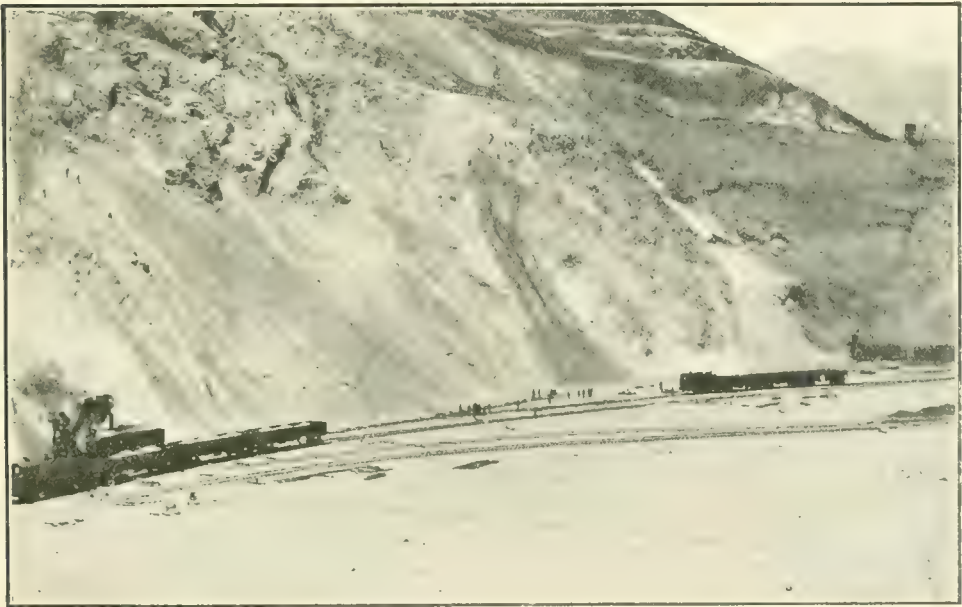
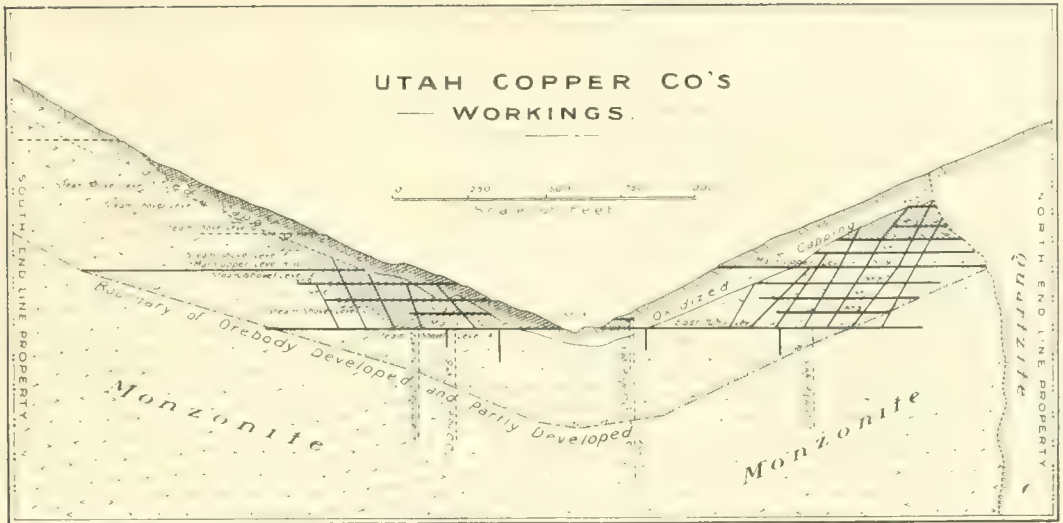
The shovels in the pit load directly to standard-gauge railway cars of 50 ton rating; these, pending the completion of the Bingham & Garfield Railroad, are delivered to the Denver & Rio Grande to be hauled to the concentrators at Garfield. The rolling stock owned by the company and used around the mine includes 34 standard and 11 narrow-gauge saddle-tank locomotives, 1 Shay engine, 125 six-yard dump-cars and 100 twelve-yard dump-cars. The equipment acquired from the Boston Consolidated included four steam-shovels, 11 narrow-gauge saddle-tanks and 190 four-yard dump-cars.

During the past year the production of the Utah Copper Co. was slightly in excess of 90,000,000 lb. refined copper produced at a cost of 8.09 cents per pound. The output would have been higher and the costs lower but for the fact that the railroad was unable to deliver the full tonnage to the mills. This will be remedied by the completion of the Bingham & Garfield Railroad. The estimate of ore developed by underground operations and churn drilling reaches the enormous total of 170,000,000 tons. At present the mill acquired from the Boston Con. is being remodelled so that the two plants will have a combined capacity of 20,000 tons daily. Even with this vast output the developed ore as now

estimated would be sufficient to run the plants at full capacity for 23 years. This fact gives some idea of the magnitude of the enterprise.

Natural gas.—The Canadian Courts have decided that natural gas is not a 'mineral.' This affects a large number of landowners in Kent and other adjacent counties, in Western Ontario, who hold their lands under deeds in which oil and mineral rights were reserved. The latter rights were purchased by oil and gas companies, which carried on operations entailing much loss and annoyance to the farmers. The latter applied to the Provincial government for relief and the Government undertook to bear the cost of bringing a test action to decide the legal point involved. The Chancellor recently gave a decision to the effect that the reservation clause in the deeds was valid as regards oil and minerals, but did not include natural gas, which belongs to the owners of the surface rights. The companies therefore will have to account to the land-owners for all profits made from natural gas.

Natural Soda in East Africa.—An unusually large deposit of natural soda has been found in the British East Africa Protectorate at Lake Magadi, not far from the Uganda railway. A company has been formed in London for the purpose of working it, under the auspices of H. Samuel & Co., of 'Shell' oil fame, and Wernher, Beit & Co., and £1,250,000 in cash has been raised for the purpose of building a branch railway and the necessary plant for treating the soda. The deposit consists of 'trona' or 'urao,' sometimes called sesqui-carbonate of soda. This salt is composed of two molecules of bicarbonate, one of monocarbonate, and three of water. It has been found from time immemorial in Egypt, and other parts of north Africa, and more recently in Hungary, India, and western America. It is formed by the evaporation of carbonate of soda solutions, and as it is taken away, so more is deposited. The deposit at Magadi is so extensive that there is every reason to believe in its commercial value. The method of treatment will be to heat it to a dull red, thus expelling water and forming soda ash. This treatment will not only produce a readily saleable product, but it will expel all the water and part of the carbonic acid and so reduce the bulk and weight of the material shipped. The heat required for this treatment will be supplied by oil fuel. The deposit is practically free from admixtures of other salts.



RECENT PROGRESS AT MAIKOP

By THEODORE J. HOOVER.

THE work accomplished during the year 1910 in the Maikop oilfield reflects great credit on the energy and executive ability of all the companies concerned. During the year more than 70 wells have been in process of drilling. Of these, 33 are equipped with power - equipments and the balance were worked with hand-equipment. The anxiety on the part of many of the companies to show some activity led to considerable expenditure in hand-drilling, much of which has been ineffective and a waste of money. The 11 wells that have been successful so far are as follows :

On December 31 work had been suspended on four wells because of mechanical difficulties. These wells had reached depths of 150, 1000, 1010, and 1750 feet.

The Maikop oilfield at the beginning of 1910 was practically a trackless forest. Everything necessary for the development of the district had to be brought considerable distances and most of the machinery ordered from Europe or America. The Maikop Roads Association, in which most of the companies co-operated, has done a good year's work in making roads and installing telephone lines and hospitals.

Plot No.	Company				Depth Ft.	Diam. In.	Initial Yield poods per day	Remarks
490	Maikop Oil & Petroleum Producers				244	10	360,000	Strong gusher ; the first on the field
490	Do.	Do.	Do.	Do.	210	3	80,000	Strong gusher
533	Maikop Spies Co.				903	10	150,000	Do.
489	Anglo-Maikop Corporation				553	8	350,000	Do.
411	London & Maikop Oil Corporation ...				847	12	5,000	Flows intermittently, good pumping well
490	Black Sea Oilfields				212	10	300,000	Strong gusher
490	Do	...	...	...	219	10	300,000	Do.
490	Do	...	...	...	312	10	300,000	Do.
123	Do	...	...	...	757	12	5,000	Good pumping well
137	Do	...	...	...	350	12	5,000	Do.
C 2	Do	...	...	...	130	12	1,000	Baled

At the original Maikop fountain-well, the flow of oil is as strong as ever, and although only 2000 poods per day is being produced, it is capable of yielding many times as much if the pipe-lines were ready to take it to market. This well is on Plot No. 490 and belongs to the Maikop Oil & Petroleum Producers.

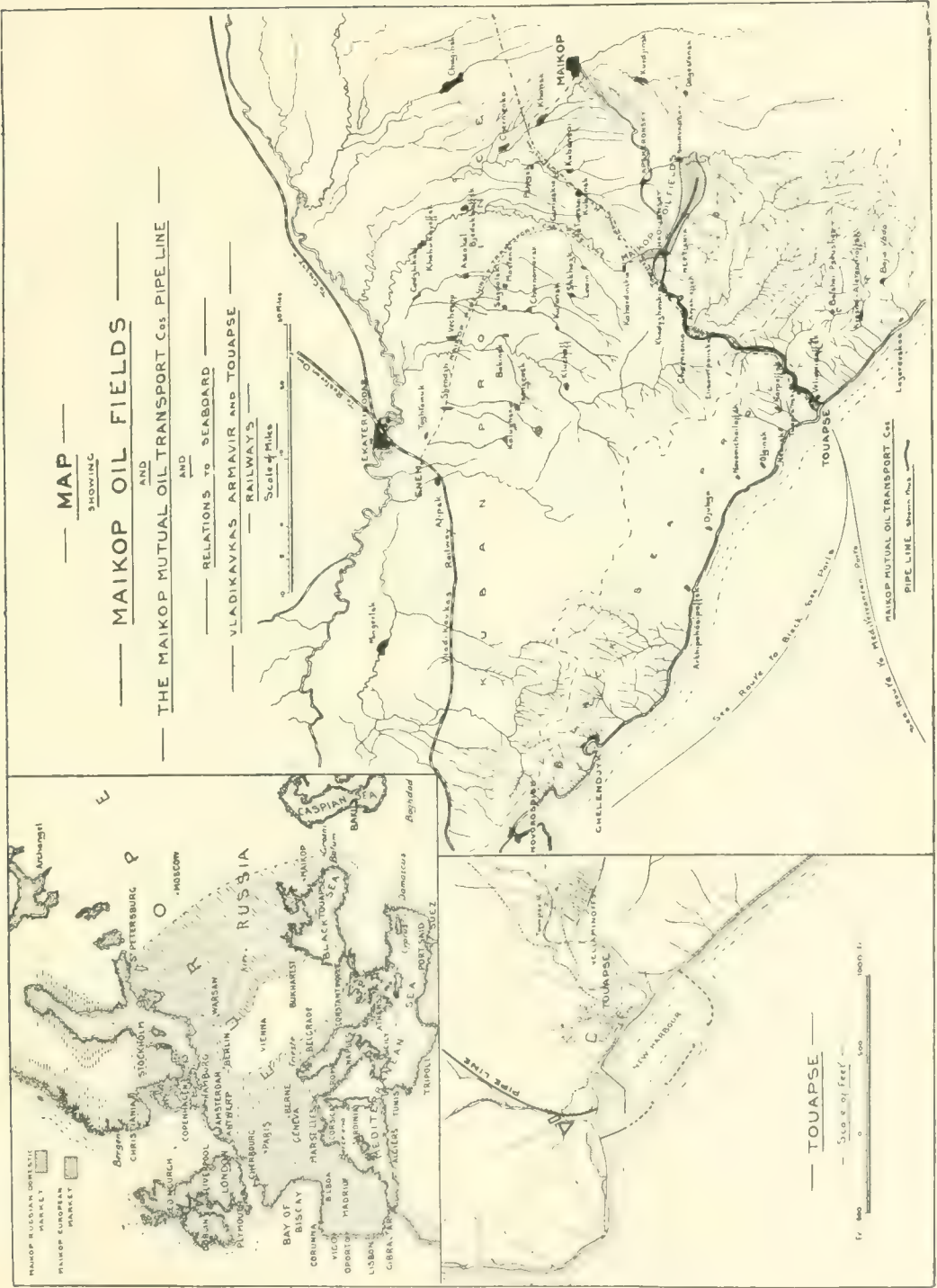
On December 31 there were 61 wells in progress as follows :

Number of Wells	Depth in feet
10.....	0 to 100
11.....	100 „ 200
11.....	200 „ 300
7.....	300 „ 400
8.....	400 „ 500
4.....	500 „ 600
3.....	600 „ 700
1.....	700 „ 800
2.....	800 „ 900
1.....	900 „ 1000
2.....	1000 „ 1100
1.....	1750

The different companies have all made progress in getting houses and barracks ready for their staff and workmen, and most of them have derricks erected pending the arrival of machinery. An ample water-supply is assured by the 6-inch water-mains and pumping station belonging to the Maikop Areas, which takes its water out of the Pshekhe river at Shirvansky, from a point above that at which the oil is escaping down the fountain valley. The Maikop Waterworks Company also has a pumping plant and a 4-inch line, which serves the district. Its source of supply is from the Pshekhe river at Shirvansky, but below Fountain creek.

The newest fountain-well is shown in the illustration. This well came in on February 1 and flowed for two days before capping was accomplished. The photograph was taken during a heavy snow-storm.

The Maikop Pipe Line & Transport Co. has nearly completed the construction of its



8-inch pipe line to the railway at Ekaterinodar, which is 70 miles distant. The pumping and receiving stations are not yet ready, but this line should be delivering oil at the refinery, to be erected at Ekaterinodar, by July.

The Maikop Mutual Oil & Transport Co. is building a 6-inch pipe-line 50 miles long to the port of Touapse on the Black sea, where a refinery will be built. The surveys are completed and construction work begun. The pipes and pumping and receiving plant have all been purchased, and are on the way. The Armavir & Touapse railway is being constructed rapidly, so that when it is finished this pipe-line will have excellent transport facilities both by rail and sea.

Maikop is more advantageously situated than Baku or Grosny, and the costs of production should be less. It is quite likely also that the wells can be pumped instead of baled, which will effect a considerable saving over the cost of production at Baku.

The Maikop Oil is of good quality, and the specific gravity is about 0.85. The following is a typical analysis:—

Product	Released at Temperature Centigrade	Percentage of Total
Benzene	100	10
"	125	8
"	150	8
Total Benzene		26
Kerosene	175	7.6
"	200	6.8
"	225	6.1
"	250	7.6
"	275	5.9
"	300	3.6
Total Kerosene.....		34.6
Spindle Oil.....	325	3.6
"	350	4.0
Total Spindle		7.6
Machine Oil	375	12.8
Residuum Fuel Oil.		18.0
Total.....		99.0

Considerable re-adjustment of markets must result from the opening of this new oil region. Its production will be large and it will have a market in Southern and Western Russia, which has hitherto been closed to Baku and Grosny. This new market will lead to a much increased consumption without materially disturbing the prices. The export market is a factor that cannot be forecasted, and it is quite possible the local market will absorb the major part of the production.

THE PRICE OF OIL IN CALIFORNIA

By WILLIAM FORSTNER.

A SHORT summary of the history of the development of the oil industry in California will explain the conditions regulating the market price of that product.

Prior to 1900 nearly all the oil produced in California came from the southern counties; in 1899 the San Joaquin valley only produced 17% of the total production of the State, and in 1900 33%; its ratio then steadily increased and in 1909 reached 68.7%. A great portion of the production in the southern counties was either high-grade refinery oil, or heavy oil used for the production of asphalt oil. The oil production increased rapidly after 1900, and overtook the consumption. The majority of this production came from small operators. At that time the Standard Oil Co. was the only large buyer of oil in the field, and taking advantage of the economic conditions it depressed the price, until in 1905 and 1906 fuel oil was only paid for at the rate of 13 to 15 cents per barrel at the well. In 1906 the operators began to organize, and the first competitor to the Standard Oil Co., the Associated Oil Co., entered the field. The low prices paid in the preceding years had depressed the production, and as the consumption was steadily increasing, these conditions combined to raise the price of oil. Until the spring of 1910 conditions were favourable to the operators, and the price paid at the well in January 1910 for fuel oil was 63 cents per barrel. The great increase in production in the Midway-Sunset field, in the spring of last year was totally unexpected. Operations in this district commenced in 1900; at the end of 1909 the Midway field was only producing 12,000 bbl. per day, and the Sunset field about 6000 bbl. It was at that time considered doubtful whether these fields would ever prove to be important factors in the oil business.

The sudden and great increase in oil production demoralized the market, and its effect would have been disastrous to the operators but for the fact that a number of properties in the meantime had come into the hands of large companies, and that in 1909 the operators had perfected another organization, the Independent Producers' Agency, which in July 1909 had entered into a contract with the Union Oil Co. of California for the



FOUNTAIN WELL, MAIKOP OILFIELD.

marketing of its oil. This combination controlled 62% of the fuel oil used in the State outside of that required by the railroads, and 37½% of the fuel oil produced in the State at the time. There were then in the spring of 1910 three principal sellers in the field: the Standard Oil Co., the Associated Oil Co., and the Union-Independent Producers' Agency.

The natural consequence of the relation between production and consumption after March 1910 was a drop in the price of oil. The Union-Independent Producers' Agency soon had a large amount of oil on hand for which it could find no market, and consequently could only pay its members for a portion of their oil at a reduced price. The net price paid its members for their oil was 44c. per barrel in February, decreasing to 43c. in June and 36½c. in September.

To understand the full purport of these figures the ruling prices in January 1910 must be considered. A number of contracts for large deliveries were made in that month at prices ranging from 50 to 65 cents per barrel, according to the grade of the oil, up to 24° B. The price of oil at Bay points was over \$1, representing 65 cents at the well. On July 1 the Standard Oil Co. reduced the price at Bay points to 90c. and continued to depress the price until in the beginning of October it contracted from 60 to 75c. per bbl. delivered at Bay points. This company is especially interested in depressing the price of oil as it produces much less oil than it requires for its refineries.

A number of small operators became gradually hard-pressed for money, even though they had joined the Independent Producers' Agency, as the Agency was only able to market part of its production. In order to relieve the situation the Agency in August perfected a plan of issuing to the individual producers certificates for the oil that was unsold and held in storage by the Agency, each certificate representing 1000 bbl., and to guarantee to the holder of such certificate 35 c. per bbl. as a minimum. These certificates are accepted as collateral by the banks in this State.

The depression of the price of oil by the Standard Oil Co. forced the Associated Oil Co. and the Independent Producers' Agency to make concessions, and prevented the latter from finding new markets for its storage oil; in September everything indicated a rate-war between the three marketing companies, which would further depress the price of oil. Luckily for the operators, the Associated Oil Co. had contracted for more oil than it produced, and

this induced this company to enter on October 1 into a contract with the Union-Independent Producers' Agency, whereby the former company became the selling agent for the latter's oil, over and above that now under contract, the Associated Oil Co. to receive a commission of 10%. The Associated Oil Co. is to make no sale contracts unless they are ratified by the Agency, and when they are so approved they are to be assigned to the Agency, which process is kept up until the businesses of both companies are equal, after which the business will be divided half and half. The contract is to run three years from date. The Associated Oil Co. is to buy outright from the Agency such oil as may be needed over and above its own production, and receipts under existing contracts with other producers to apply against the Associated's outstanding contracts with consumers. The oil thus required by the latter company is about 5000 bbl. per day, thus already providing a market for 150,000 bbl. per month of the surplus oil of the Agency. The oil certificates above mentioned have now the combined guarantee of the Associated Oil Co. and the Union Oil Co. to the Agency. A minimum price of 35 cents at the well is now established, adding to this the 10% commission of the Associated Oil Co.; this establishes a price of nearly 40 c. per bbl. at the well for fuel oil as a minimum.

One of the first results of this contract was the raising of the price of oil at Bay points to 80 cents a week after the contract was signed.

Another factor, which helped to support the market last summer, is the position taken by the Southern Pacific railway company. The railroad companies are prominent users of fuel oil. The Southern Pacific has leased a large part of its oil-lands to outsiders, and is operating other parcels through a subsidiary company, the Kern Trading & Oil Co. The leases generally carry the provision that the Southern Pacific has the privilege of buying the oil produced by its lessees at the prevailing market price; during the summer of 1910 it used this right throughout, but paid its lessees 50 cents per bbl. for the oil.

We may then assume 35 cents per bbl. as the minimum figure for fuel oil at the well, with the probability that the price will be better, as both the principal marketers, the Associated Oil Co. and the Union Oil Co. are large producers of oil, and have now no inducement to depress the price. The main factor now is to extend the market for the oil, to which both companies are seriously devoting their energy.

PRÉCIS OF TECHNOLOGY

Origin of Rand Gold.—In our last issue we gave an abstract of R. B. Young's address to the Geological Society of South Africa on the origin of the Rand deposits. Owing to exigencies of space the abstract was not a complete one, so we give herewith those parts dealing with the origin of the gold. With the general widening of our knowledge of ore deposition there have been changes in the theories of the origin of Rand gold. The placer theory has retired into the background, and Voit has even presented it in a form approaching the infiltration theory, holding that the gold was derived from ascending solutions, which over-flowed at the surface and mingled locally with the sea-water during the deposition of the conglomerates. Infiltrationists have gradually modified their views. Most of them regard the conglomerates as having been the channel for solutions before the interstices between the pebbles were filled with cementing material. The early supporters of the theory attributed the deposition of gold from the ascending solutions not to a chemical precipitant but to the physical changes in the solutions.

This contention that the gold was precipitated wholly by physical causes at once raises the question of how it came about that the conglomerate beds in one particular horizon were so favoured, while others were practically neglected. In answer to this, Kuntz asserts that "the conglomerates in which pebbles are lying immediately one on another are, generally speaking, richer than those in which the pebbles are imbedded in a surrounding fine-grained matrix," and he explains this by supposing that the most rapid percolation took place in those conglomerates in which the intervals between the pebbles were least filled with sand. This explanation was afterwards adopted by Beck. Curtis, on the other hand, remarks: "The gold is unquestionably limited to certain seams of conglomerate. It is also limited to certain quartz lodes in formations where the deposition of the gold is unquestionably due to infiltration." Hatch and Corsforth, in 1904, took the view that "the limitation of the gold deposition to definite zones was probably due to certain chemical conditions, as, for example, the presence of some reducing agent existing in these and not in the other beds," and suggested that pyrite, or possibly carbonaceous matter, had something to do with the precipitation. In the second edition of their 'Geology of South Africa' this is repeated, with the substitution of iron salts in place of pyrite.

In 1908 Mr. Young came to the conclusion that the infiltration theory was only tenable on the assumption that there was a heavy precipitating agent in the blanket. This conclusion was reached mainly by a study of the 'banded pyritic quartzite,' sometimes found associated with the conglomerates of the Main Reef series. This banded pyritic quartzite has been mentioned by other writers in the course of discussions on the blanket. Thus Gregory likens the pyritic bands to layers of black iron-sands, such as are found on the beaches of New Zealand. Voit, who devotes a considerable space to its description, regards it as "the strongest evidence against both the alluvial and the infiltration theories." How the rock constitutes evidence against the placer theory he does not clearly show, but he emphasizes the fact that the evidence is against any theory which depends on the original porosity of the conglomerates compared with that of the accompanying quartzites. Mr. Young was the first to investigate this rock microscopically, and to show that the pyritic bands are identical in composi-

tion with the matrix of the blanket. Detrital grains of chromite are frequent in the pyritic bands and absent from the intervening non-pyritic quartzite. Grains of zircon are as common in the pyritic bands as in the matrix of the blanket, while the secondary minerals in the two are identical. In fact, the pyritic bands may be described as blanket without pebbles; when, as occasionally happens, pebbles do appear in these bands, the resulting rock becomes typical blanket. What are now pyritic bands were at one time layers of sand, in which a certain degree of concentration of heavy minerals had taken place, as in the pebbly beds. As pointed out by Voit, this rock could not have been originally more porous than the associated barren quartzite, nor can any plausible reason be assigned for the concentration of light organic matter, or its decomposition products, in those layers of sand that contained the heaviest minerals and in the pebbly beds.

Mr. Young's line of reasoning therefore leaves only one alternative to the placer theory, namely that the gold and pyrite were precipitated by a heavy, detrital substance, the grains of which would naturally come to rest in the same places as the other heavy minerals in the sediments. At the present day no heavy detrital mineral capable of bringing about the reduction of gold and pyrite from solution can be detected in the blanket, but the assumption that such a mineral was at one time present requires no greater exercise of faith than does the assumed presence of a mineral capable of reacting with sulphuretted hydrogen to produce pyrite, which forms an absolutely essential part of the latest and best presentation of the placer theory. The infiltration theory, then, takes two distinct forms; one, the older, depending on physical causes for the precipitation of the gold, and the other, which appears to be preferable, depending mainly on chemical causes.

History of the Canadian Nickel Industry.—At the meeting of the Canadian section of the Society of Chemical Industry, held at Toronto on January 13, D. H. Browne, of the Canadian Copper Co., read a paper on the history of the nickel industry in Canada and the United States. Up to 1870 the chief supplies of nickel ore came from Norway, and from 1870 to 1890 most of it came from New Caledonia. Since then the Canadian ores have taken the lead. Mr. Browne's paper relates how the Canadian ores were developed. John Gamgee, an Englishman, was in 1876 endeavouring to make a refrigerating machine applicable for producing a low temperature in hospitals for the cure of yellow fever, and the United States Navy Yard gave him special facilities with this object in view. He found that the ammonia gas leaked through cast iron, and he and S. J. Ritchie, of Akron, Ohio, decided to make an iron containing nickel similar to meteoric irons. This was expected to be impervious to the gas. Owing to the government not continuing to provide funds, the idea of a nickel-iron lapsed. At about the same time Robert M. Thompson and his partner, W. E. C. Eustis, were developing a deposit of nickel ore at Orford, Quebec. The ore contained small amounts of sulphide of nickel, or millerite, distributed in a matrix of calcite, chrome garnet, and pyroxene. Mr. Eustis put up a reverberatory furnace and tried to smelt the ore, but was unsuccessful on account of the refractory nature of the slag. They closed the mine and transferred their attention to a copper deposit at Capleton in Quebec. There they made a copper matte which they sold to Hunt and Douglas, copper refiners at Phoenixville, Pa. In order to extend their business they decided to

He then turned over a marketable Home, New Jersey, and Ontario Copper Works, and a share of the property to Mr. Thompson, and leaving to Mr. Thompson the ownership of the Orford Works. As Mr. Thompson had no mineral supply he sent agents out to purchase copper ores. Just about this time, 1885, copper was discovered in the Sudbury district of Northern Ontario.

In the year 1882, S. J. Ritchie became interested with others in the Central Ontario Railway, which was built to open up the iron ore deposits of Hastings county, Ontario. His group acquired a large tract of iron land, but the ore unfortunately proved too high in sulphur to be of marketable value. Mr. Ritchie visited the Sudbury district in 1885 and found there what appeared to be valuable deposits of high grade copper ore. He took options on these, returned to Cleveland, and organized the Canadian Copper company. At that time nothing was known of the occurrence of nickel in the Sudbury ores. In 1887, the Canadian Copper company commenced to mine copper ore. This ore was a chalcopryite containing pyrrhotite and pentlandite. At that time, however, nothing was known about pentlandite and everything in the ore not copper pyrite was classed as 'iron.' In 1887, 167 cars of picked copper ore were shipped, part to Nichols' chemical works on Long Island, and part to the Orford Copper Works. The Nichols Chemical company were unable to make refined copper from these ores and turned their shipments over to the Orford Copper company. This company also experienced the same trouble, an unknown element entering the blister copper, hardening and whitening it and making it worthless. In the winter of 1887 nickel was discovered to be the interfering element, and a campaign of education was begun to discover how to treat this element. The first problem, on which the life of two companies depended, was to remove this metal, and leave marketable copper. The second was how to recover the nickel and sell it.

At this time there were three interests in control of the nickel business. The Societe le Nickel, owned by the Rothschilds, controlled the New Caledonia nickel mines, and had five factories in France, Germany, and the United Kingdom. The New Caledonia ores contained 5 or 6% of nickel in a gangue of magnesium iron silicate. This ore was brought from New Caledonia, smelted with gypsum or alkali waste, giving a nickel iron matte, which was treated in reverberatory furnaces or Bessemer converters till the iron was all slagged off and a pure nickel sulphide was left. This required only roasting and reduction to give a pure metal. The Societe le Nickel practically controlled the nickel trade of the world, which at that date (1887) amounted to less than 1000 tons a year. In England, the Vivians of Swansea produced a little nickel from the nickel copper ores of Norway. They conducted their business with absolute secrecy, having no patents on record. All that was known of their business was that in some way salt cake was one of the ingredients used.

In the United States Joseph Wharton, of Camden, N. J., had been making nickel since 1862, using ores from the Lancaster Gap mine in Pennsylvania. He used a wet process, dissolving nickel iron matte in hydrochloric acid, precipitating the iron by lime, and separating nickel and cobalt by the old method with bleaching powder. Mr. Wharton's industry had in 1882 been crowded out by the Societe le Nickel, which with its New Caledonia ores was producing more nickel than the world consumed. Mr. Wharton's ore was

low grade, containing only about 1½% nickel, and he dealt more with cobalt oxide and nickel salts than with metallic nickel.

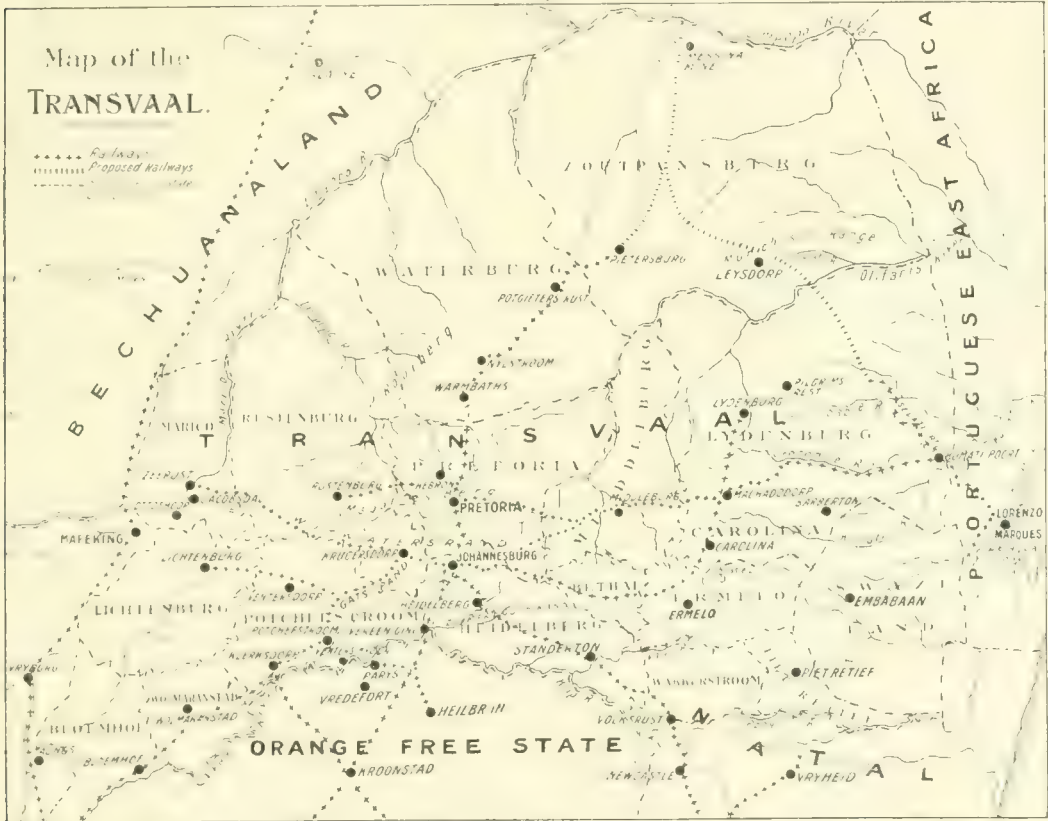
After many months of work the Orford Copper company discovered that if a copper-nickel-iron matte were melted with carbon and an alkali sulphide, two products were given, first a 'top' or lighter upper part containing the larger portion of the copper and iron with some nickel, and second, a 'bottom' or heavier portion containing the major part of the nickel with some copper and iron. By repeated re-smeltings of these products with alkali sulphide a comparatively clean separation could be made, copper soda iron sulphides going one way and nickel soda sulphide going the other way. In 1888 the Canadian Copper Company decided to erect a smelter and ship a nickel-copper matte, which the Orford Copper company was ready to receive. The first smelter was erected by Dr. E. D. Peters in 1888, and blown in on December 23 of that year. The furnace building was 35 by 40 ft., and contained one small Herreshoff furnace 3 ft. 6 in. by 6 ft. at the tuyeres. The early work on this furnace was a series of desperate struggles. In 1889 the company produced 8450 tons of matte, which contained about 1600 tons copper and 1200 tons nickel. This was sold in small lots to Wharton, to Vivian, and to others, and in large lots to the Orford Copper company. As in this year the total nickel production of New Caledonia was only 1332 tons, it was evident that Canada was producing as much nickel as the world could consume.

Just at this time, James Riley, manager of the Steel Company of Scotland, read a paper before the Iron and Steel Institute relating to the advantages of nickel steel. Mr. Ritchie showed this to the Secretary of the United States Navy, who collaborated with the Canadian Prime Minister in forming a commission to investigate the subject of nickel steel armour plate in Europe. Their report was satisfactory and the United States government adopted nickel steel for the navy. In 1890 the Canadian Copper Co. decided to start a refinery of their own and commissioned Jules Garnier to start a smelter. He erected a Bessemer plant at Copper Cliff to free the matte from iron, and plant at Cleveland, Ohio, to produce pure metal. This was not a success, and subsequently Carl Hoepfner tried his electrolytic process for separating nickel and copper with equally unsatisfactory results. In 1897 the Canadian Copper Co. investigated the Mond process but did not adopt it. Nothing was found as suitable as the Orford process. The Mond people eventually started a smelter at the Victoria mine in Sudbury and shipped the matte to Clydach, Swansea. After ten years of struggle the process was perfected and the company is now earning large profits. In 1902 the International Nickel Co. was formed to amalgamate the Canadian and Orford companies and to absorb Mr. Wharton and other small producers. The only competitors are the Mond Company and the Societe le Nickel.

Improvements in Copper Smelting.—The *Engineering and Mining Journal* for March 4 contains an interesting article discussing the lines on which possible improvements in copper smelting are being investigated by American metallurgists. They have perfected the mechanical methods of handling material in and about their works, they have increased the size of their furnaces to what now seems to be the economic maximum, and have to a large extent solved the problem of handling fine ore to advantage, so they are again turning their attention to more purely metallurgical improvements. Some noteworthy advances

have lately been made, the most far-reaching being the introduction of the basic-lined converter. An interesting innovation that is shortly to be tried on a large scale is the blowing of high-grade, fine concentrate into the converter. A special tuyere for this purpose has been invented, by means of which a careful adjustment of the feed into the converter is accomplished. This method is to be employed at Cananea for the treatment of the Miami concentrate, and probably at other smelters. It is the successful introduction of the basic-lined converter that makes this new departure possible. If it works satisfactorily copper metallurgy will have made a long stride toward real

done much good work in Cornwall, especially at the East Pool dressing works, for the purpose of designing an entirely new plant. This plant is now to be built, and it is described in the *South African Mining Journal* for February 11. The ore will be sent to stamps of which ten are to be erected at once and another ten later on. The crushed ore will then go to two Callow screens which will make two sizes suitable for two sets of Hartz jigs. The concentrate produced in the jigs will be sent direct to a Brunton furnace for the removal of sulphur, the tailing will be run to waste, and the middling will go to a tube-mill for regrounding. The underflow from the Callow screens



MAP OF THE TRANSVAAL SHOWING ROOIBERG TIN DISTRICT.

pyritic smelting, and the treatment of exceedingly fine ore will have ceased to be a worry.

Tin Dressing at Rooiberg.—We have several times recorded the progress of the Rooiberg tin mine in the Transvaal, and in our issue of December last we gave particulars of the work done. Above we publish a map of the Transvaal showing the position of this mine, which is 70 miles north by west of Pretoria. The property was developed by the Oceana Company, but the control passed recently to the Anglo-French-Farrar group. The old 10-stamp mill treated about 1300 tons of ore per month, producing on an average 50 tons of concentrate containing 68% tin. The extraction was not high, being only 62% of the estimated content. The new consulting engineer, E. J. Way, engaged Amos Treloar, who had

will go to classifiers to separate the sand from slime. The sand will go to Wilfley tables; the concentrate there obtained will go to the Brunton furnace, and the middling will go to the tube-mill along with that from the jigs. The tube-mill product will go to classifiers, and to another set of Wilfley tables, and the middling produced will go to Frue vanners. The slime after dewatering will go to automatic rag-frames, and the concentrate there produced will be further treated on revolving buddles and Acme tables. The concentrate produced in all these treatments will go to the roaster, and the product will be sent to magnetic concentrators for the removal of the iron.

Vanadium in New Mexico.—In our issue of November 1909, we gave a description of an important source of vanadium ore in Montrose county, Colorado, and

...the only known formation about the vanadium...
 Mining Section for Mexico... in account of a new source of supply in New Mexico. The...
 miles from Cutter, a station on the Santa Fe railway, between Albuquerque and El Paso. The properties were originally prospected for galena, but it was soon found that vanadinite, or vanadate of lead, was present in commercial quantities. The Vanadium Mines Company of Pittsburg has erected a treatment plant at Cutter. The concentrate is brought from the mines in motor wagons and dumped into large lead-lined vats containing dilute sulphuric acid. The charge is agitated by steam jets and the vanadium goes into solution as sulphate. This is decanted and evaporated, and the residue thus obtained roasted for the production of vanadium oxide. The lead in the vanadinite is left as a sulphate residue in the vats. The vanadium oxide is shipped to Pittsburg for the use of steel makers. The article does not quote figures for the amount of concentrate treated nor of the oxide produced. The only guide to an idea of the extent of the industry is the fact that the treatment plant cost \$100,000.

Ventilation in Mines.—At the meeting of the Australasian Institute of Mining Engineers, held in January at Thames, New Zealand, Frank Reed, of the New Zealand Mines Department, read a paper reviewing the present standards of ventilation in metal mines. He did not treat the subject from the point of view of the dust problem, but confined himself to a discussion of the various regulations designed to supply fresh air. The two standards measuring the hygienic requirements are: (1) the quantity of air supplied per man per minute as gauged by the anemometer, and (2) the quality test as determined by analysis. A quantity standard is adopted in New Zealand and Queensland, where 100 cu. ft. per man per minute is required. In the Transvaal and Victoria the minimum is 70 cu. ft., though in Victoria the chief Inspector may order this amount to be increased to as much as 500 cu. ft. This quantity standard is not altogether satisfactory, for the amount of air required for adequate ventilation varies within wide limits according to the conditions found in the individual mines. For instance deep mines require far more air in order to reduce the temperature of the rocks. Then the velocity varies according to the sectional area of the air-ways, and the results of measurement by anemometer vary correspondingly. Again the nature of the arrangement of stoppings and brattices makes all the difference in efficiency of ventilation. Finally the organic matter given off by men and animals, and also the exudation of noxious gases from rocks and minerals, vary between wide limits. As an example of the last-named consideration, the author drew attention to the fact that at the Thames mines enough carbonic acid sometimes issues from the rocks to extinguish lights and endanger life, the gas being presumably produced by the action of acid water on carbonates.

The quality standard is based upon the amount of carbonic acid present, and the proportion of oxygen contained in the air. In Victoria this test has been established as well as the quantity standard; it has been adopted as the regulation test in Western Australia; and has recently been recommended for adoption in the Transvaal. These standards have followed laws enacted in 1910 in Great Britain for the regulation of air in factories, by which the maximum amount of carbonic acid is fixed at 20 parts per 10,000. In Victorian mines the maximum is 25 parts, with not

less than 20% oxygen. In Western Australia the maximum is 25 parts except for 30 minutes after blasting when a greater but unspecified percentage is permitted. The proposed regulation in the Transvaal allows 20 parts of carbonic acid.

In Great Britain the members of the Royal Commission on Mines in the report issued in 1909 did not consider that the same regulations were necessary for mines as for factories. They considered that as much as 125 parts of carbonic acid per 10,000 and not less than 19% oxygen were figures that might be adopted as a standard of maximum impurity. This recommendation was the result of thorough investigation by J. S. Haldane and John Cadman, and their physiological reasons were given at considerable length. It was found that most of the carbonic acid came from mineral sources, and that only a small proportion came from respiration, therefore it was held that the carbonic acid in mines was not so deleterious as that in factories.

With regard to the limiting of temperatures in deep mines, the Victorian regulations provide that the maximum temperature shall be 87° F dry bulb and 80° F wet bulb, but this regulation is permitted to be elastic at the discretion of the Inspector. The Transvaal Commission adopted 80° F as the maximum wet bulb temperature, but no legislation is considered necessary at present as there are very few mines where this temperature is reached. Mr. Reed endorses the views of the British Royal Commission on all points connected with the ventilation question, and urges that the regulations in Australasia are unnecessarily strict.

Low Speed Chilean Mills.—In our issue of January we quoted the practice in connection with low speed Chilean mills used in Siberia for treating gold ores. In this connection it is of interest to read an article in the *Mining and Scientific Press* for March 11 by E. E. Carter describing the practice at the Gold Hill mine at Quartzburg, Idaho. The ore at this mine consists of a comparatively soft quartz with 5% of sulphides, of which pyrite is the chief, together with some galena and stibnite. Gold is the only valuable constituent of the ore and it is associated with the stibnite. When the mine was first worked the ore was treated in stamps, then the pulp separated into sand and slime in a cone classifier, allowing the overflow to pass over amalgamating plates and the underflow going to be reground. It was intended to supplement amalgamation by concentration and cyanidation. Owing to so much gold being lost in float, plate amalgamation was abandoned and the whole output of the stamps sent to a low speed Lane Chilean mill. Exceedingly good results have been obtained, the recovery having increased from 50 to 81%, with prospects of improvement. No further treatment will be required after this amalgamation in the Chilean mill. The plant as now working consists of 20 stamps of 1000 lb. each, crushing to 4 mesh. The Chilean mill is 10 ft. diam. and has 6 rollers the weight of each of which is 2000 lb. Additional crushing weight of the same amount is given by placing a tank filled with scrap iron or rock above the framework carrying the rollers. The mill revolves slowly, the number of revolutions being not over 8 per min. The rollers are set at a slight angle to the tangent, thus giving a grinding as well as a crushing action. The sides of the mill are set at an angle of 60°, and the pulp is fed through six pipes revolving with the rollers, one feeding immediately behind each roller. No screen is used and an overflow discharge is employed instead. An excess of mercury is employed and this and the amalgam accumulates in the annular wells at the side of the dies. It is stated

that hardly any mercury is lost. Fuller details about capacity and power required would be of interest. The author invites discussion and contributions relating to experience with this class of machine.

Cyaniding at Nevada Wonder Mine.—In the *Engineering and Mining Journal* for March 11, P. E. Van Saun describes the all-sliming method of dealing with the ore found at the Nevada Wonder mine at Wonder, Nevada. The ore consists of hard tough quartz containing a small amount of sulphides. Gold is found in the ore principally in the free state, and the silver is chiefly in combination in the sulphides as argentite and stephanite. After protracted experiment it was found best to crush to 200-mesh, then concentrate on slime tables to remove the sulphides, and treat the tailing by cyanide. Owing to the hardness of the quartz, rolls were discarded in favour of ten 1400 lb. stamps which crush to 4-mesh, followed by Chilean mill and tube-mill. A weak solution of cyanide is used in the stamps. The pulp from the stamps goes to spitzkasten, from which the coarser material goes to a 6 ft. Chilean mill, where it is re-ground in weak cyanide solution to pass 30-mesh. This product unites with the overflow of the spitzkasten and goes to a Dorr classifier, which removes everything finer than 200-mesh, the coarser part being sent to a tube-mill, which also works with a cyanide solution. The product of the tube-mill goes back to the Dorr classifier and continues in this closed circuit until fine enough. The discharge from the Dorr classifier goes to Callow tanks for thickening and then passes to six No. 3 Deister slime tables on which the sulphides are removed. The concentrate recovered by the Deister tables goes to the smelter. The tailing from these tables joins the overflow from the Callow tanks, and the whole goes to a Dorr thickener where it is thickened to a consistency of 2 tons liquid to 1 ton solid. The thickened slime flows into a concrete sump from whence it is delivered by a pump to a collecting tank that is provided with a mechanical agitator. This tank is placed at a level above the treatment vats so as to allow the pulp to flow to them by gravity. By this arrangement the time occupied in collecting the pulp in the treatment vats is saved. There are 4 treatment vats, each 45 ft. high and 15 ft. diam. The pulp is agitated and aerated for 48 hours in strong cyanide. When the extraction is complete the pulp goes to stock tanks where it is kept in a state of agitation mechanically and from which it is sent to two Oliver filters. These filters are continuous in their operation and the solution from them is discharged into two tanks from which it is run into five 7-compartment zinc-boxes using zinc shavings as precipitant.

The mill is driven electrically by current generated at Lundy, 125 miles away, and transmitted at 52,000 volts. For treating the solutions and warming the mill in winter, steam piping is used, the steam being generated in boilers of the locomotive type, and the fuel used being oil. The water supply is brought 11 miles through steel pipe. The mine is 65 miles away from the railway, and communication over the desert is effected by means of gas-traction engines.

Circular Shafts.—We have on several occasions recently referred to the use of circular shafts in metal mines, and have mentioned the new shaft at the New Modderfontein as an innovation on the Rand. The *South African Mining Journal* for March 4 gives reminiscences of earlier practice, and reminds its readers that circular shafts were sunk at Langlaagte Royal, New Unified, and New Primrose, by L. Hamilton, who appreciated their advantages as regards cheap-

ness of sinking and timbering, strength to resist rock pressure, and facilities for ventilation. The Modderfontein shaft will be 22 ft. diameter, which is just double the diameter of Mr. Hamilton's shaft at Primrose. The Langlaagte Royal shaft was 15 ft. in diameter.

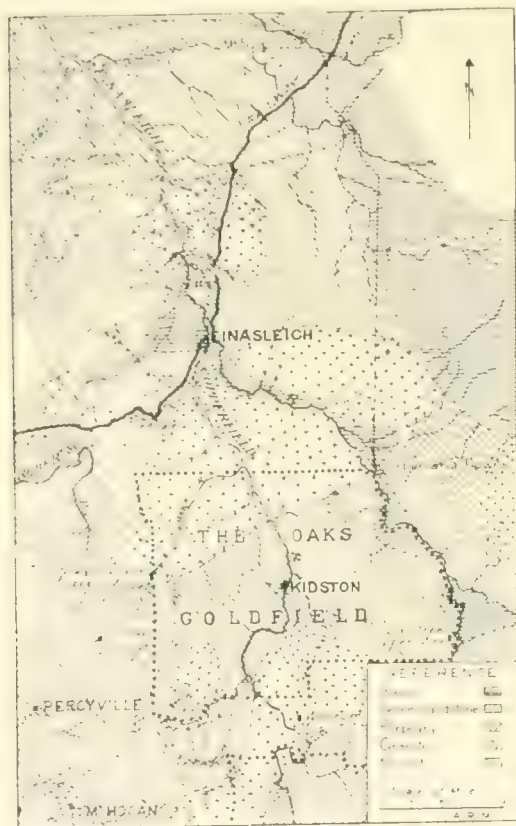
The Arbuckle-Way Cyanide Process.—The Arbuckle process invented on the Rand has been described several times in various publications. Recently it has been announced that it has been abandoned at the East Rand Proprietary Mines. This decision is not taken by the inventor as final, for other mines on the Rand are trying the process, and in the case of the Benoni it has been modified and adapted by the consulting engineer, E. J. Way. The *South African Mining Journal* for March 4 gives an outline of the modified plant, that is now being erected at Benoni. The mill-pulp will go to a Stadler classifier, from which the separated slime will go to the Arbuckle settling cone and the sand to the Caldicott dewatering filter. The dewatered products from these two sets of apparatus will go conjointly to a mixing agitator, where cyanide solution will be introduced; afterwards the mixed pulp will pass to air agitators for the completion of the extraction. After the extraction treatment the combined sand and slime, together with the solution carrying the gold, will go through another set of classifiers and dewaterers, and in this way 98% of the solution will be withdrawn. The remaining sludge is mixed with a wash solution and treated in the same way. The important point in connection with this new method is that the time required for the solution of the gold is only 4 or 5 hours. This treatment of the sand and slime in the same extraction plant is a novel feature in cyanide practice.

Origin of Petroleum.—The *Mining World* (Chicago) for March 4 quotes at some length the views relating to the origin and migration of petroleum, published by Raymond S. Blatchley in the Illinois Geological Survey's Yearbook. He reviews the two theories of its origin, the organic and inorganic. The latter theory was brought forward when the discoveries were made that the carbides of certain metals can be broken up into hydrocarbons by the action of water, and that the alkali metals produce hydrocarbons when brought into contact with water saturated with carbonic acid gas. It was supposed that the interior heat of the earth was sufficient to produce these carbides which were afterwards split up by percolating water, and later on the hydrocarbon gases would be condensed as liquids when they arrived at cooler strata. The presence of hydrocarbons in volcanic gases may be explained by this theory. As regards the organic origin of petroleum, chemists have shown that animal and vegetable matter when heated in a closed retort or allowed to decay in the absence of air yield liquid and gaseous products similar to petroleum and natural gas. The animal and vegetable matter deposited in muddy water may be the original formation from which by physical and chemical forces the oil shales have been formed. Similarly the limestones containing oil would be marine deposits. The shells would be the origin of the limestone and the animal matter that of the oil. Mr. Blatchley himself is more in favour of the organic than the inorganic theory, though he admits that the latter may explain the origin of some of the occurrences. He then proceeds to elaborate the explanation of the migration of the oil from its point of generation and its method of occurrence at the present time. As, however, this part of the subject was fully treated in Mr. Beeby Thompson's paper last month we will not refer to it on the present occasion.

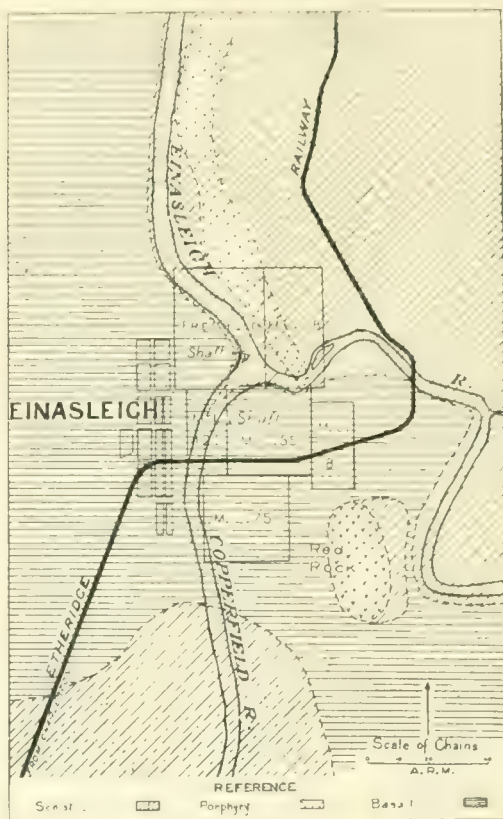
The Crown Mines Equipment. At the visit of the members of the Council of Metallurgical and Mining Society of South Africa to the Crown Mines in February, an official description of the new method of mining and metallurgical treatment was circulated. The Crown Mines is an underground mine of the Crown Reef, Crown Deep, Robinson Central Deep, South Rand Langlaagte Deep, Langlaagte Royal, Paarl Central and a number of unlevelled claims on the dip. At the time of consolidation there were nine main shafts and four stamp-mills. On the re-arrangement of underground and surface work, there

5 shaft will deal with the ore raised from the eastern end. It will be 3400 ft. deep vertically, and in addition to the main haulage level at the 13th level, two other haulage ways will be provided on the 16th and 19th levels. The crushing plant at the top of the shaft will have a capacity of 2000 to 4000 tons per day of 10 hours. The broken ore from the two crushing stations can be carried to any of the batteries.

As regards the metallurgical treatment the present plant contains 675 stamps and 20 tube-mills together with cyanide plant. These are arranged as in the days before consolidation: (1) at Crown Deep, 300 stamps



Geological Map of Einasleigh District.



Enlarged Map of Einasleigh

will be only two haulage shafts, No. 5 and No. 7. These two shafts will handle 9000 to 10,000 tons daily. They will be connected on the 13th level at a vertical depth of 2200 ft. This will be the main haulage level; it will be 14½ ft. wide and practically straight from one end of the property to the other. The electric haulage system will be arranged in such a way that the ore may go to either shaft. No. 7 shaft is partly vertical and partly on the incline, and it is being altered so as to convert the hoisting to double stage. There will be four hoisting ways in the vertical part, with 4-ton skips, and four hoisting ways on the incline with 5-ton skips. The crushing station at the top of this shaft will handle 3500 to 4000 tons per day of 10 hours. This shaft is in the western part of the property and will as a rule deal with the ore from the Langlaagte Royal, Paarl Central, and Langlaagte Deep. The No.

and 10 tube-mills, (2) Langlaagte Deep, 200 stamps and 6 tube-mills, (3) Crown Reef, 120 stamps and 3 tube-mills, (4) the old Bonanza mill, 55 stamps and 1 tube-mill. The capacity of these four mills is 165,000 tons per month. A fifth mill is being erected with a capacity of over 35,000 tons per month. The most interesting feature of the cyanide plant at the Crown Reef mill is the installation of the Butters filter and Brown agitator. There are two Butters filter-boxes each with 150 leaves. The estimated capacity was 500 tons of slime per day, but in practice 900 tons is being passed through, owing to the Rand slime being peculiarly adapted to this process. The plant was started on August 12, 1910, and after being tested for six months under the direction of the owners of the process, has now been taken over by the Crown Mines company.

Einasleigh Copper Mine.—The *Queensland Government Mining Journal* for January contains an official report by E. O. Marks on the geology and ore deposits of the Eastern Etheridge and Oaks mineral districts in North Queensland. These districts are served by the railway which is a continuation of the Cairns and Chillagoe railway to Charleston, from which town it is to be eventually carried through Georgetown to Croydon, connecting there with the Normanton railway. The Oaks district is a small goldfield and is not of great note, but the Eastern

by various owners from time to time. It is only within the last two years or so that any substantial orebodies have been found. The mine is situated at the junction of the Copperfield and Einasleigh rivers, and the shaft is sunk through the basalt flow into the gneissic schist, which is clearly exposed in the river bed and which dips at about 60° . The ore occurs in the form of lenticular masses of which four have so far been found. The orebodies are separate lenses with the longer axes parallel to the strike of the schist. They are not found along the line of a fissure, a fact proved



NORTH QUEENSLAND, TO SHOW POSITION OF EINASLEIGH.

Etheridge district is of interest to English readers, because it contains the Einasleigh copper mine. The accompanying maps show the geology of the district. The most important rocks are a series of schists varying in character. These contain the ore deposits so far discovered. Their dip is steep and their strike approximately north and south. They contain layers of granite the origin of which is not yet fully explained. Other parts of the country are covered with porphyry and basalt, and on the highest parts of the flat-topped Newcastle range of hills running north to south along the western side of the country shown in the map are layers of desert sandstone belonging to the Upper Cretaceous. The Einasleigh mine was discovered by Daintree in 1867 and it has been worked

by the absence of any outcrop of such a fissure at the surface. The main orebody now being worked does not reach the surface, and the outcrop discovered by Daintree was part of a distinct lens. In fact the surface indications are not favourable to prospecting. The ore now being extracted consists of chalcopryite and pyrrhotite in a quartz gangue, other minerals present being garnet, hornblende, calcite, and gypsum. The average content is 7% copper. The greatest width of the main orebody is on the 3rd level where it is 50 ft. wide and 200 ft. long. Hand-picked ore is at present shipped north to the Chillagoe smelter, 120 miles by rail, and a dressing plant is being erected for the treatment of the lower grade ore; this will be in operation during the course of the present year.

CURRENT LITERATURE

Mine-Dust.—At the January meeting of the Chemical, Metallurgical, and Mining Society of South Africa, J. L. Agnew read a paper dealing with a review of the mine-dust problem, the effect of mine-dust on the lungs, and proposed methods of prevention. One of his points was that under most present systems of ventilation the air is circulated in a continuous current throughout the workings and he urged engineers to devise some plan of short-circuiting the foul air.

Meco Hammer-Drill.—The *Iron and Coal Trades Review* for March 10 gives details of tests of the Meco double-valve hammer-drill, conducted at the Rotherham Main collieries and at the Votty and Bowydd slate quarries.

Electric Pumping.—At the February meeting of the National Association of Colliery Managers, held at Darlington, J. R. Jameson described the work done at the Sherburn colliery by the Victoria high-lift electric centrifugal pump.

Pumping in New Zealand Mines.—At the January meeting of the Australasian Institute of Mining Engineers, held at Thames, New Zealand, two papers were presented describing the Cornish pumps at the Waihi and Thames-Hauraki mines, written by W. P. Gauvain and A. C. MacDiarmid respectively.

Porter's Slime Concentrator.—The *Mining World* (Chicago) for February 25 describes the machine invented by E. C. Porter at use at the Morenci concentration plant belonging to the Arizona Copper Co. It consists of a series of twelve canvas tables arranged one over the other vertically and quite near each other. It occupies little space and one man can attend to ten of them. The alternate flows of slime and water are worked automatically.

Overstrom's Classifier.—In the *Mining World* (Chicago) for February 25, G. A. Overstrom describes his apparatus of classifying pulp into several different sizes.

Electrolytic Assay of Copper.—The *Mining World* (Chicago) for March 11, publishes a paper by G. L. Heath describing the use at the Calumet & Hecla smelting works of F. C. Frary's electrolytic cell used for determining copper. In this cell the solution is revolved rapidly by electric induction instead of the electrodes being rotated.

Cyanide Analysis.—In the *Mining and Scientific Press* for March 11, E. M. Hamilton suggests an improved method for estimating thiocyanate in cyanide solutions containing much silver.

Sampling Pulp.—In the *Engineering and Mining Journal* for March 4, W. O. Borchardt describes an automatic sampling device for sand, slime, tailing, etc., consisting of a horizontal revolving wheel carrying a sampling bucket in the form of a narrow sector.

Metallurgy at Waihi.—At the January meeting of the Australasian Institute of Mining Engineers held at Thames, New Zealand, E. G. Banks gave a full history of metallurgical operations at the Waihi mine, and A. Fyfe described those at Waihi Grand Junction.

Copper in Cuba.—In *Mines and Minerals* for March, E. G. Tuttle describes the El Cobre copper mine in Cuba. This article supplements the paper by B. B. Lawrence, an abstract of which was published in our issue of August 1910.

Canadian Iron Ore.—*Mines and Minerals* for March contains an article, abstracted from Canadian official reports, reviewing the iron ore resources of Ontario and Quebec, Canada.

Cuban Iron Ore.—The March *Bulletin* of the

American Institute of Mining Engineers contains six papers by various authors on the iron ore deposits of Cuba.

Tin in Transvaal.—The *South African Mining Journal* for February 18 contains Dr. Merensky's report on the tin veins found on the Rhenosterhoekspruit in the Waterberg district of the Transvaal; the property is to be worked by a new company called the Century Tin Mines.

Peat Fuel.—The *Canadian Mining Journal* for March 1 contains an article by Ernest V. Moore on recent advances in the manufacture of peat fuel, especially in connection with the Government installation at Alfred, Ontario, between Montreal and Ottawa.

Price of Explosives.—At the January meeting of the Chemical, Metallurgical, and Mining Society of South Africa, William Cullen, manager of the Modderfontein explosives factory, predicted a general rise in the price of explosives having nitro-glycerine as a base, due to the continued advance in the price of glycerine.

Feeding Natives on the Rand.—At the January meeting of the Chemical, Metallurgical, and Mining Society of South Africa, F. W. Watson read a paper giving the results of analytical examinations of the cereals and beverages supplied to the natives in the mine compounds. He found that they were usually adulterated and urged that they should either be bought on analysis or the cereals purchased in the unground state and the beverages made on the spot.

Canadian Mineral Production.—The *Canadian Mining Journal* for March 15 contains the full reports relating to the mineral production of Canada, and also the detailed reports on the production of the provinces of Ontario and Quebec.

Copies of the original papers and articles mentioned under 'Prices of Technology' and 'Current Literature' can be supplied on application to The Mining Magazine.

BOOKS REVIEWED

CRYSTALS. By A. E. H. Tutton. Cloth octavo, 300 pages, with 120 illustrations. London: Kegan Paul. Price 5s. For sale by *The Mining Magazine*.

This book is one of the celebrated International Science Series which makes a feature of the attractive presentation of advanced science, somewhat after the manner of the lectures before the Royal Institution. Mr. Tutton's book is the expansion of popular, though far from elementary, lectures delivered before the British Association at Winnipeg in 1909. It would have been better to make the title 'The Romance of Crystallography,' or 'The Natural History of Crystals'; these alternative titles indicate sufficiently well the scope of the book.

THE MINING YEAR-BOOK, 1911. Edited by A. N. Jackman, with an Introduction by J. W. Broomhead. Cloth, octavo, 1200 pages. London: *The Financial Times*. Price 15s. For sale by *The Mining Magazine*.

This year-book is on the same lines as the older and better known Skinner's Mining Manual. It gives particulars of all the mining companies registered in England.

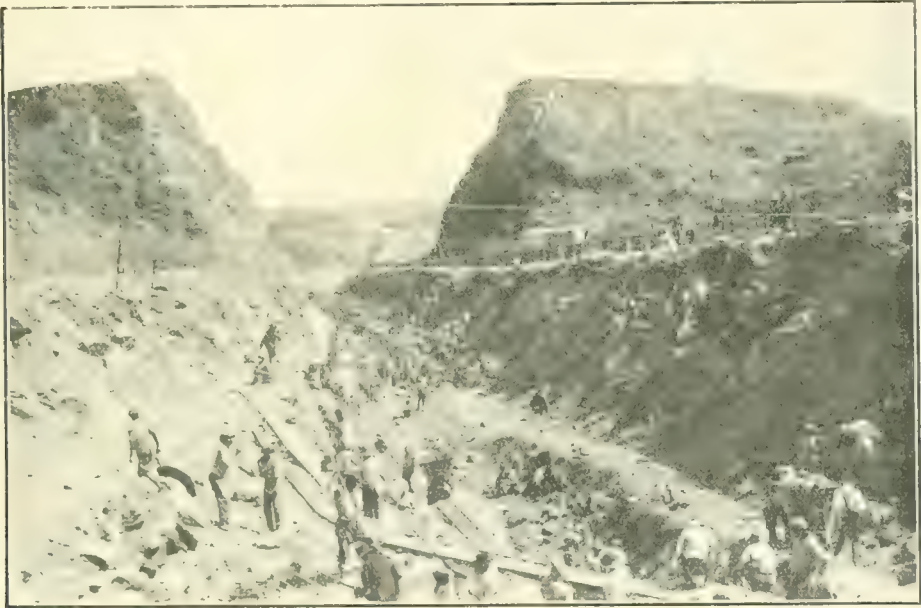
PRACTICAL MINERALOGY SIMPLIFIED.—By J. P. Rowe. Cloth, octavo. 162 pages. New York: John Wiley & Sons; London: Chapman & Hall. Price 5s. 6d. For sale by *The Mining Magazine*.

This book is written in simple language and is intended for the purpose of helping miners and prospectors to identify minerals.

COMPANY REPORTS

Premier Diamond.—This company was formed in 1902 to work the diamond mine situated north of Pretoria. The government was the vendor and takes 60% of the profits. Afterwards 160,000 preferred shares of 5s. each receive a dividend of 250%, and 320,000 deferred shares of 2s. 6d. take the balance of each year's profit. The deferred shares have so far received three yearly distributions of 400% and one of 200%. The mine is notable for having been the place of origin of the Cullinan diamond, and also for the fact that enormous amounts of very low grade ground are handled. During the depression in the diamond market two and three years ago the work at this mine was not notably curtailed, as was the case at De Beers. The report for the year ended October 31,

what it was. The ordinary shareholders have seldom received any returns, and a few years ago it was found desirable to reduce the capital in order to bring the nominal figures more into line with the amount of business transacted. In the year 1909 the company reached low water mark, and it is gratifying to be able to record that the year 1910 has presented more favourable features. The deliveries were 838,000 tons, as compared with 774,000 tons in 1909, and 781,000 tons in 1908. The profit was £109,973, as compared with £100,438 in 1909. Out of this, £54,000 has been paid as debenture interest, being $4\frac{1}{2}\%$ on £1,200,000, and £25,000 is being distributed among preference shareholders, being 5s. per £6 share, which is entitled to 7% or 8s. $4\frac{1}{2}$ d. Some years ago it was found that, owing to changes in economic conditions, it was impossible for inland towns to compete successfully for



THE PREMIER DIAMOND MINE

1910, shows a further increase in the output, the number of loads (each of 16 cu. ft.) raised and treated being 9,331,882, or $2\frac{1}{4}$ million more than during the previous year. The advance would have been even greater but for the shortness of labour supply. The yield of diamonds was 2,145,832 carats or 0.23 carat per load, as compared with 0.249 carat in 1909. The cost of mining and washing was 1s. $11\frac{1}{2}$ d. per load, or 8s. 6d. per carat. The washing plant has been extended so as now to be capable of treating 50,000 loads per day. The diamond account placed to the credit of revenue was £1,496,641, and the profit was £489,915, of which £293,949 goes to the government and £195,966 to the shareholders.

Salt Union.—This company, by far the largest producer of salt in England, was formed in 1889 as an amalgamation of many companies operating in the Cheshire salt basin. During the first year the production was 1,650,000 tons, and the profit was £320,400. Since then competition on the part of manufacturers in other countries for both the home and export trade has been keen, and the production is now only half

foreign trade, and it was therefore decided to establish a new refining works at Weston Point, on the Manchester Ship Canal. The brine from the wells is pumped thither in pipes. These new works are practically ready to commence work. An unfortunate circumstance in connection with the scheme is that the owners of a canal which the pipe-line crosses are disputing the right of way, and a lawsuit is threatening. On the other hand, a more favourable fact is that there is a great demand for the Union's electric power, generated at Weston Point for use at the works and for public sale. At the meeting of shareholders held on March 17, the chairman announced that they had an option on James Hodgkinson's new process for refining salt, about which so many sensational paragraphs have appeared in the daily Press.

Broomassie.—This company was formed originally in 1901, and was reconstructed twice, the last time in October 1909. It owns vein mines 20 miles north-west of Tarkwa, West Africa, and dredging rights on the Ancobra and Mansi rivers. Bewick, Moreing & Co. are the general managers, and A. M. MacKilligin

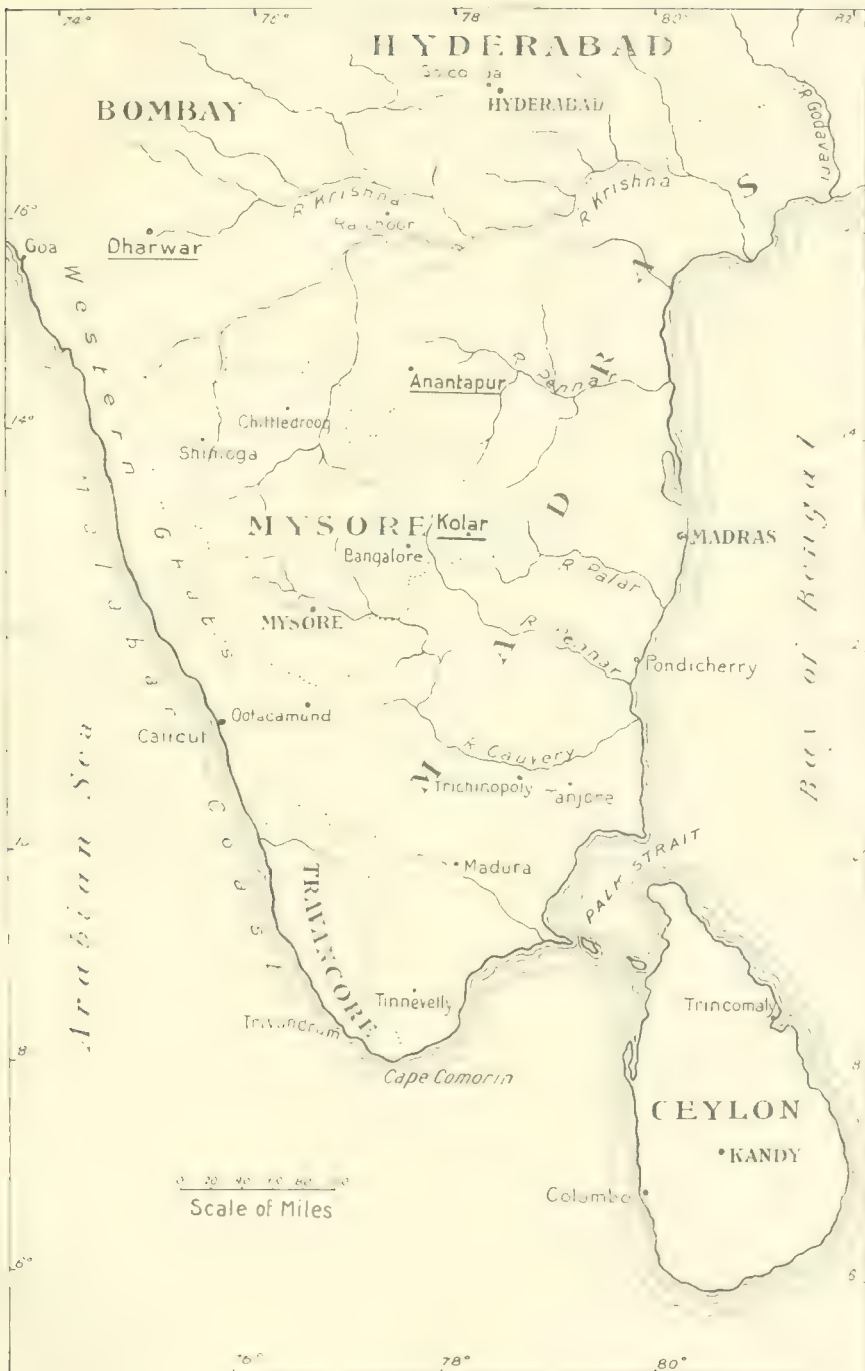
is superintendent. Milling started in 1904, and cyanide and concentration plants were added in 1908 and 1909 respectively. Metallurgical operations were then suspended while the mine was further developed, and were only restarted last month. The directors' report now issued covers the period from reconstruction to September 30 last, and the general manager's report brings information down to March 1, on which date the ore reserve in the West Reef was 20,889 tons averaging 29 dwt., and in the East Reef 149,528 tons averaging 6 dwt. Additional plant has been ordered so as to increase the capacity to 3500 tons per month. The railway connection with Sekondi has been made, so that the business of the mine will be greatly facilitated.

Mysore Gold.—This company continues to hold its position as the premier mine of the Kolar gold mining district in Mysore State, India. The report for the year 1910 shows the largest amount of ore treated and the largest yield since the commencement of operations 27 years ago, and though the deepest workings are 2800 ft. vertical from the surface or 4000 ft. on the incline, the ore reserves and the development results are as satisfactory as at any time in the history of the mine. These facts are naturally a cause of great gratification to such old believers in the Kolar district as Captain McTaggart and General Beresford, and of course to the firm of managers, John Taylor & Sons. The report for 1910 shows that 246,425 tons of ore was crushed in the stamps and 201,056 oz. bullion recovered by amalgamation; in addition 190,530 tons of tailing was cyanided and yielded 27,631 oz. The total production of gold was worth £895,467, which was £600 more than during 1909. The yield since 1884 has been £12,575,989. The working cost for the year was £355,489, royalty to the Mysore government £47,910, income tax £25,131, depreciation £8503, and expenditure on plant, etc., £73,524. The dividend absorbed £350,750, which was at the rate of 115%, and £40,000 was placed to the reserve fund. The actual amount of profit was apparently less than that for the years 1904 to 1907, but it must be remembered that nowadays all expenditure is charged against revenue, instead, as in former times, special expenditure being provided for by the issue of new shares. For some time the grade of the ore has been slightly diminishing, but improved methods of mining and extraction have more than counterbalanced the fall in content. In fact it is the improved methods of handling the ore and of extracting the gold that has made it possible to treat the lower grade ores. The costs per ton during 1910 were 4s. less than in 1909. During the past year, 32,383 ft. of development work was done, and the ore reserve increased by 87,803 tons, standing on December 31 at 1,100,453 tons. The report by the superintendent, Arthur Gifford, shows that the developments continue to be satisfactory. The equipment of the new vertical circular shaft, Edgar's, sunk for the purpose of facilitating operations in the northern part of the mine has been completed for some time, and the surface plant is now being erected. It is proposed to sink another vertical shaft with circular cross-section at the southern end, where the present shaft is not convenient for hauling and the winding engine has come to the limit of its capacity. The new shaft will be 16 ft. diameter and is to be sunk to 2400 ft.

Nundydroog.—This company owning the gold mine in the Kolar group, Mysore, India, managed by John Taylor & Sons, shows a record output and profit for 1910. Not only so but the developments at depth are encouraging and point to a continuance of profits.

The company was first formed in 1882, but it was not until 1888 that satisfactory results were obtained. Since then the output has steadily advanced, with the exception of 1898–9–90, when a lean zone was passed through. The report for 1910 shows that 91,000 short tons of ore was sent to the stamps, and that 81,293 oz. bullion was extracted by amalgamation. In addition, 84,280 tons of tailing yielded by cyanide 7436 oz. bullion. The total production of gold was worth £334,748, the working cost was £153,813, royalty to the Mysore Government £18,984, income tax £7221, depreciation £10,773, amount placed to reserve £20,000, and dividend £117,916 being at the rate of 41½%. This dividend is the highest yet paid, a result which is not fully appreciated until it is recollected that recently all expenses formerly charged to capital account are now being paid out of revenue, and also that a reserve fund is being built up. Other items of note are that the additional ground acquired from the Tank Block is proving useful in facilitating development, that the price paid for electric power to the Cauvery Falls company has been reduced, and that the ore reserve has been increased during the year, standing on December 31 at 141,296 tons. The superintendent, Charles H. Richards, gives a detailed account of the developments at various points, and draws special attention to the valuable discoveries on the 2450 ft., 2600 ft., and 2750 ft. levels in Kennedy's section. Mr Richards also reports that he has been investigating the question of treating the large accumulation of slime, and that he expects to make a definite proposition in the course of the current year. Two years ago the company acquired an option on the Jibutil block in the Anantapur goldfield, Madras Presidency, and since then W. Stonor, the superintendent, has prosecuted developments. His report is incorporated with the Nundydroog report; he shows that the shaft has been sunk to 450 ft., and that levels have been driven at 130 ft., 250 ft., 350 ft., and 450 ft. The ore reserve is 21,200 tons, and at all the levels the indications are good. The directors have therefore decided to complete the purchase and to float a separate company to work the property.

Ooregum Gold.—This company belongs to the same group as the Mysore and Nundydroog mentioned above. The mine began producing in 1888 and the first dividend was paid in 1891. It is not so large a property as the Mysore, Champion Reef, or Nundydroog, and it has passed through more vicissitudes. The last period of low-grade ore was from 1905 to 1907, but in 1909 the gold content once more rose and averaged 12½ dwt., as compared with 8½ dwt. in 1905. The report for 1910 shows that 133,407 tons of ore was sent to the mill and yielded 80,934 oz. bullion; in addition 122,051 tons of tailing yielded 12,833 oz. bullion. The total production was 34,151 oz. fine gold. The extraction per ton was about 12½ dwt., practically the same as in 1909, and the total yield was the largest in the history of the company. The income from the sale of gold was £357,119. The current expenditure was £175,157, royalty £20,270, income tax £7286, depreciation of plant £6000, and allocation to cost of new shaft £9000. A reserve fund has been started with £15,000 out of the year's profits. The dividends absorbed £129,250, being 42½% on the £120,000 preference and 32½% on the £240,772 ordinary. The working costs have been appreciably reduced during the year and were 26s. 3d. per ton, as compared with 29s. 5d. in 1909; hence the possibility of paying an increased dividend and starting a reserve fund. The amount of development work done during 1910 was 16,298 ft. and the reserve on December 31 was 164,534 tons, a slight increase



SOUTHERN INDIA.

to maintain the present yield during the current year. The directors have also decided to build a new shaft to a depth of 1,100 ft. on the dip. For some time the directors have contemplated securing other property, and the opportunity has recently been presented of taking a 3-years option on claims 12 miles to the north of the Kolar district. This property contains ancient workings, and a vein has recently been discovered in them 60 ft. from the surface. The Ooregum company is intending to spend £5000 in exploration work upon it.

Fermiskaming.—This company was formed in 1906 to work a property at Cobalt, Ontario. The control is in Toronto, and Norman R. Fisher is manager. Dividends were first paid in 1908. The production of silver from the beginning to January 31, 1908, was 452,229 oz., and during the two succeeding years ended January 31, 1909 and 1910, the figures were 976,027 oz. and 676,675 oz. During the latter year developments were undertaken on a large scale and a concentration plant was built. The report now issued covers the 11 months ended December 31, 1910, the directors having decided to make their financial year coincide with the calendar year. The report shows a striking advance in production and profits. The total amount of ore raised from the mine during the period was 18,456 tons averaging just over 100 oz. per ton. Out of this, 359 tons of ore was obtained by hand-picking, containing 1,329,368 oz. silver. At the concentrating plant, 300 tons of first-class concentrate containing 471,735 oz. was obtained, and 351 tons of second grade concentrate containing 59,430 oz. Nuggets and low-grade hand-picked ore accounted for about 12,000 oz., so that the total production for the year was 1,872,707 oz. The receipts from the sale of ore and concentrate were \$1,022,390, and the expenses \$308,071, leaving a profit of \$714,319. Out of this \$275,000 has been distributed as dividend, or 11% on the capital. The manager reports that the main shaft is down 540 ft. and that high-grade ore is still being found at this depth, with no indication of any immediate change. He gives full details of development work, cost of operations, etc., together with a flow-sheet of the concentrating plant.

British Columbia Copper.—This company owns the Mother Lode mine in the Boundary district, British Columbia, it and the Granby being by far the largest producers of copper in this part of the country. A map showing the mines in the district was published on page 373 of our issue of November last. The control is in New York, and J. E. McAllister is manager. In our notice on March 1910 we mentioned that operations had been suspended for three months on account of the strike at the Crow's Nest coal mines. This year the directors report that labour difficulties at the Mother Lode mine either stopped or hindered work from the middle of April to the middle of July, with the consequence that for quite three months the company was not earning a profit. During the year ended November 30, 1910, the amount of ore mined and shipped was 359,502 short tons, and 40,722 tons was received at the smelter from other mines. These ores were smelted direct and yielded 3185 long tons of copper, 24,962 oz. gold, and 84,180 oz. silver. The average yield of the Mother Lode ore was 18 lb. copper per ton and \$1.23 gold and silver. The average price obtained for the copper was 12½ c. per lb. The working profit for the year was \$256,561. No dividend was distributed. The company has completed the purchase of the Wellington Camp claims, and an aerial

ropeway has been constructed to connect with the Lone Star mine. The Rawhide and Athelstan claims, belonging to the New Dominion Copper Co., the control of which is in the hands of the British Columbia Copper Co., are being developed, and at the Napoleon mine a cyanide plant is being erected. The company is therefore looking towards a substantial increase in its revenue in the near future, over and above that derived from the Mother Lode mine. The amount of ore received at the smelter will be much greater in the future, so the capacity has been increased by 33% by doubling the length of two of the three furnaces. The company reports also that the Kettle River railway, which is being built by the Canadian Pacific, will reach the Nicola Valley coal mines some time during 1911, and that this should result in obtaining before long a cheaper coal and coke supply than comes from Crow's Nest.

Esperanza.—This company was registered in London in October 1903 to acquire the majority of shares in the Esperanza Mining Co., a New Jersey corporation that owns and operates the Esperanza gold mine at El Oro, Mexico; R. J. Frecheville is a director of the English company, L. B. Sutton is consulting engineer for the American company, and Charles Hoyle is manager at the mine. The report of the English company now issued covers the year 1910 and with it is issued the report of the American company. During 1910, 133,258 dry metric tons of oxidized ore and 54,850 tons of sulphide ore were mined and milled, together with 5668 tons of dump material. The yield of gold was worth \$2,133,896, and the net profit was \$858,669. The ore reserve on December 31 was 367,363 dry metric tons, from which a profit of \$1,408,618 is expected to be made. The report quotes the yield and profit per ton in terms of short tons, the figures for the yield being \$9.37 as compared with \$10.44 in 1909, and the profit \$3.74 as compared with \$3.71. Mr. Hoyle gives details of the mine and of the new cyanide plant which started in June. Information relating to this has already appeared elsewhere in our columns. The amount of profit of the English company for 1910 was £135,276; out of this £130,230 has been distributed as dividend.

Portland Gold Mining.—This company is registered under the laws of Wyoming, and has worked the gold mine of this name at Cripple Creek since April 1894. Down to the end of 1910, gold to the value of 31½ million dollars has been extracted from 1,100,800 tons of ore, and \$8,677,080 has been distributed as dividends. During the last two years the yield of high-grade ore has shown signs of decline, and it became necessary to adopt new ideas for the continuance of operations. Two new departures were adopted. One was the driving of a deep adit for the purpose of reducing the water level, and also with the object of prospecting for further ore supplies. The other was the building of a plant to treat the dump ore and the large reserve of low-grade ore left in the mine. There is some secrecy with regard to the nature of the cyanide process used at the plant erected for this purpose, but it is commonly reported to be based on the Clancy method. The report of the directors for 1910 shows that \$307,676 has been spent on this plant to date and that its present capacity is 350 tons per day. It started operations in July and many adjustments and alterations have been necessary, among other things additional crushing machinery being required owing to the hardness of the rock. The plant was to have started on dump ore, but owing to much low-grade ore having to be removed from the mine during the course of development work, it was decided, in order to eliminate the expense of placing this ore on the

dump and subsequently rehandling it at some future time, to send it straight to the new mill, leaving the old dump untouched at present. To the end of December gold to the value of \$113,253 was recovered in this plant, but the amount of ore treated and the cost are not given. During the year 67,515 tons of high-grade ore was shipped to the Colorado Springs plant, and the yield was \$1,241,168 in gold, or \$18 32 per ton. The net profit for the year was \$372,424; \$241,870 was written off for depreciation, and \$240,000 was distributed as dividend.

Mount Boppy.—This mine belongs to the John Taylor & Sons group. It is situated in the Cobar district of New South Wales and has been producing gold since 1901 and yielding dividends since 1902. The metallurgical equipment contains 40 stamps that were acquired from the Gallymont company. At first the ore was oxidized and showed the usual secondary enrichment, so that from the commencement to 1908 the profits were large. During the years 1905 to 1908 the dividends were 47½% on a capital £121,000. Subsequently the grade of the oxidized ore fell and the workings came into sulphide, but nevertheless the dividends were 27½% in 1909 and 35% in 1910. The report for 1910 shows that 47,082 tons of oxidized ore and 31,608 tons of sulphide ore were sent to the battery where 11,199 oz. was produced by amalgamation. In addition the cyanide plant extracted 17,973 oz., and 317 tons of concentrate sold to smelters yielded 2314 oz. The total production was therefore 31,486 oz., or 8 dwt. per ton, and it sold for £132,048. The working cost was £79,685, income tax £3191, depreciation £4042, and allocation to capital expenditure £3000. The dividend distributed absorbed £42,350, bringing the total distribution to date £395,382. The directors contemplate altering the metallurgical methods, in order to obtain a higher extraction from the sulphide ore which is now predominant. It is proposed to adopt the all-sliming method, and a new plant consisting of tube-mills, agitators, and filter-presses is to be provided. Experiments show that by this means an additional penny-weight can be extracted per ton, giving on 80,000 tons an increased yield of £16,400. The superintendent, James Negus, reports that the developments at depth towards the south end of the property indicate that the two orebodies which at the northern end are the two legs of an inverted saddle have come together and partake of the nature of an ordinary fissure vein. There is therefore a prospect of an extended life for the property. The reserve of ore on December 31 was 234,684 tons, an increase of 9000 tons during the year.

Mount Bischoff Tin.—We gave a very complete record of this celebrated tin producer in Tasmania in our issue of September last, and we referred at the same time to the excellent work done by J. D. Millen in applying petrological science to the discovery of further bodies of tin ore, and so prolonging the life of a mine that was supposed to be near exhaustion. The half-yearly report for the period ended December 31 shows that the profits are not only being maintained but are increasing. The amount of ore mined during the half-year was 123,508 tons, of which 12,844 tons was rejected and 110,664 tons sent to the stamps. The yield was 550 tons of concentrate or 10'63 lb. per ton of ore. This compared with 530 tons during the first half of 1910, and 525 tons for the second half of 1909. The development work at the faces of the various open-cuts and in the underground workings has fully maintained the ore reserve. The working cost at the mine was 3s. 10½d. per ton distributed as follows: mining 2s., hauling 4½d., concentrating 10½d., pros-

pecting 2½d., administration 2½d., and other expenses 2½d. The low cost is explained by the fact that the rock is soft and requires no great expenditure of energy in mining and crushing. The company's smelting works at Launceston treated in addition to the 550 tons produced at the mine, 1593 tons of purchased ore, a total of 2148 tons, from which 1484 tons of metal was produced, of which 373 tons came from the company's own concentrate. The net profit for the six months was £35,311, as compared with £25,760 during the first half of the year. Out of the profits, £13,400 was spent on plant and waterworks, and £21,000 was distributed as dividend. The new plant includes 10 stamps and conveniences for handling and distributing the ore. By means of this new machinery it is expected that the cost of mining and concentration will be still further reduced.

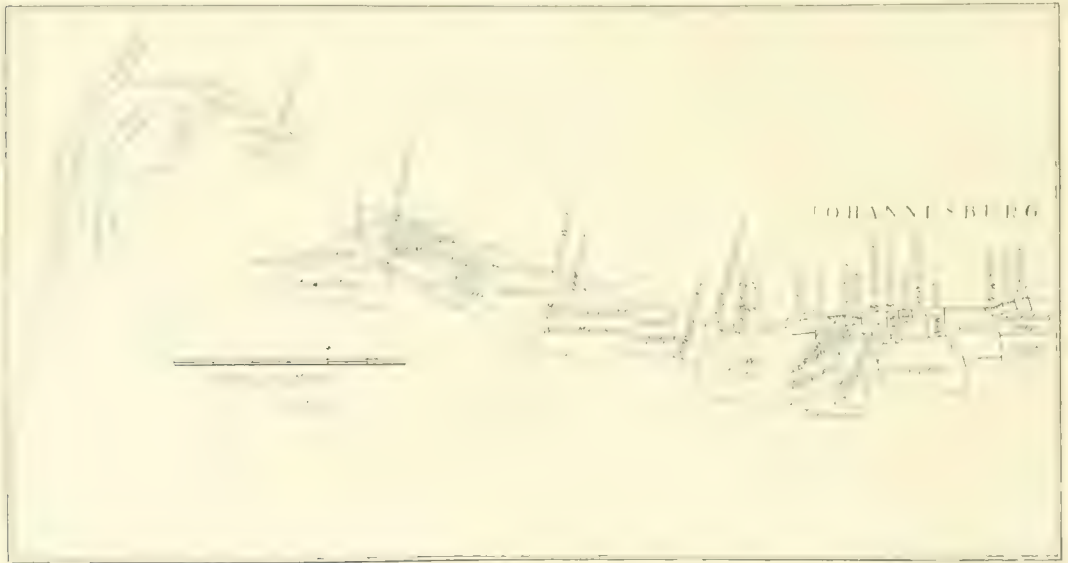
New Lisbon Berlyn.—This company was first formed in 1885, to acquire gold mines near Pilgrim's Rest, Transvaal, and has been five times reconstructed. The last time was in 1906 when the Hamilton-Ehrlich group took the property in hand. E. T. McCarthy is consulting engineer, and Charles Hunter is manager. In our issue of March last year we gave a detailed account of the deposits; we recorded that the old properties, Lisbon and Berlyn, have been abandoned and the work concentrated on the more recently acquired Frankfort property. The deposits are found in bedded form intercalated between dolomite and shale. There are two principal beds, the Theta and Bevvitt's, the latter 250 ft. above the former. Their outcrops have been traced for a considerable distance, and the amount of ore must be immense. The ore is oxidized at the surface, and as the drifts go in, pyritic ore is found. So far the treatment of the oxidized ore only has been considered. The old plant was in a dilapidated condition, and it was decided to build an entirely new one on modern principles. The report of the company for the year ended September 30, 1910, and the speech by the chairman, F. B. Lawson, at the meeting of shareholders held on March 14, contained the gratifying information that the company is now on a profit-earning basis. The new plant was not completed until November, so that during the year covered by the directors' report the benefit of it was not felt. The old plant was kept running until the end of June, but the more interesting information relates to the performance of the new mill. This mill contains 20 stamps, amalgamating tables, tube-mill, cone-classifiers, sand - vats, and Brown agitators, otherwise Pachuca vats. The capacity is 3000 tons per month, but so far it has not been possible to treat more than 1300 tons per month on account of lack of water. To make up for the deficiency of water-supply a gas power-plant has been ordered and should be ready for use in May. The recovery in January was 86%, which is a great improvement over the results obtained in the old plant. In spite of the drawback of lack of power, profits have been made since the starting of the new plant, amounting to £3948, during the four months November to February inclusive. Mr. Hunter estimates that the ore blocked out on September 30 amounted to 19,615 tons averaging 9'8 dwt. The amount of development work done during the year was 8115 ft., and 2'6 tons of payable ore was uncovered for each foot of work done. Prospecting is being prosecuted at the Lisbon and Berlyn properties and a number of rich leaders have been found on the former. Probably the company will not work these, but will let them on rent or royalty to tributaries.

Langlaagte Estate.—This company, belonging to the Robinson group, has worked an outcrop mine in

the central part of the Rand since 1889, and was at one time a leading producer. Ten years ago it began to be left behind by larger and newer mines. In September 1909, a consolidation was effected with Block B and Langlaagte Exploration, thereby greatly extending the life of the company and affording chances of economy. The report for 1910 now issued shows that the benefit of this policy has already become apparent, for the dividend was £260,850, as compared with £177,425 in 1909. During the year 200 stamps and 5 tube-mills treated 629,614 tons of ore. The yield by amalgamation was 112,742 oz. and by cyanide 89,515 oz., a total of 202,257 oz. worth £847,447. The extraction was 6.42 dwt., or 26s. 11d., per ton crushed. The estimated reserve blocked out on December 31 was 1,267,769 tons. A large amount of development work has been done during the year for the purpose of opening the deeper levels. The profit for the year was £331,873, out of which £260,850 was distributed as

and also 472,366 cu. ft. of stations, sumps, etc. The ore reserve on December 31 was 2,788,099 tons, an increase of 104,866 tons, as compared with the figures a year ago. The average content was estimated at 7.8 dwt.

Randfontein Central.—This company was formed in 1907 to acquire a number of properties of the Robinson Randfontein group in the far west Rand, and adjoining the Randfontein South. So far the work has consisted of extensive developments through 5 shafts, and the erection of a great crushing plant, containing 600 stamps and 16 tube-mills. Half the plant started in February and is treating development rock. On December 31 the ore reserve was estimated at 2,822,713 tons averaging 7.3 dwt., and there is also about 700,000 tons of ore blocked out, of which the value is not reported, and nearly 400,000 tons of development rock on the surface. Since the end of the year it has been decided to amalgamate the Central and South companies. For this purpose the capital



GENERAL SKETCH MAP OF

dividend, at the rate of 30%, £31,739 paid as taxes, and £54,021 spent allocated to capital expenditure, chiefly for sinking and equipping a new shaft on the Block B part of the property.

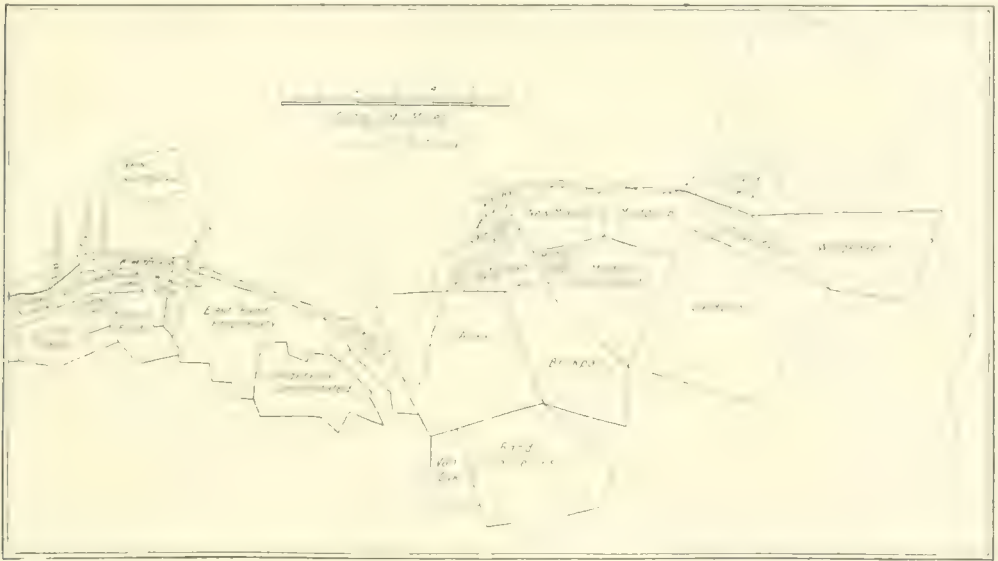
Randfontein South.—This company was formed as the Robinson Randfontein by J. B. Robinson in 1895 to acquire property in the far west Rand, and in July 1909 it was consolidated with others of the same group. The equipment consists of 400 stamps and 13 tube-mills, together with accessory cyanide plant. A scheme has recently been approved for amalgamation with the Randfontein Central. During 1910 the Randfontein South treated 1,168,641 tons of ore, which yielded 200,841 oz. in the batteries, and 181,511 oz. in the cyanide plant, a total production of 382,352 oz., worth £1,600,414, or 27s. 5d. per ton. The expenses were £1,063,694, or 18s. 2d. per ton, and the profit £538,584, or 9s. 3d. per ton. Debenture interest absorbed £41,625, taxes £54,573, and dividends £300,000. In addition, £95,031 was allocated to capital expenditure, devoted to shaft-sinking, electrification, and enlargement of the native compounds. The amount of development work done during the year was 40,219 ft.,

of the Central is being increased by 2,000,000 new shares of £1 each, which will be paid to the South company as purchase price. The issued capital of the Central company will then be £4,000,000, and there will be also 500,000 unissued shares of £1 each. The indebtedness of the Central is £2,164,342, and of the South £1,284,000. This money was advanced by the parent company, the Randfontein Estates, and is secured by bonds and debentures. The amalgamated company will assume the responsibility for these debts.

Jubilee.—This company was formed in 1886 to acquire a small property on the Rand outcrop, and milling commenced in 1887. The head office is in Pietermaritzburg, Natal. The metallurgical work is done jointly with that of the adjoining Salisbury mine which is in the same control. The battery consists of 100 stamps of which 40 treat the Jubilee ore. The report now published covers the year 1910. During this period 62,389 tons was mined, and, after sorting, 55,011 tons was sent to the mill, where 7110 oz. was recovered by amalgamation, being 2.58 dwt. per ton. In addition, 38,218 tons of sand yielded by cyanide

3222 oz., and 13,556 tons of slime 605 oz., while 328 oz. was extracted from dump materials and by-products. The total yield was 11,265 oz. and the yield per ton of current ore was just under 4 dwt. The average assay of the residues was 0.37 dwt. The gold produced was worth £47,000, and the working cost was £44,572. For some time the ore milled has been only low-grade leavings. The yield per ton for 1910 was 4s. 7d. less than that for 1909. It is doubtful whether the property will be worked much longer, for though the claim-area indicates a life of 3 years, the quality of the ore left in the mine is low. The mine has been highly profitable in the past, on the basis of a small capital. During 1910 the capital was increased from £50,000 to £90,000 by the creation of 40,000 new shares; of these 35,000 have been subscribed for by shareholders, and the cash so raised has been devoted to the acquisition of shares in a new company called the Claremont Mines Rhodesia, Ltd., which was

closed 88,707 tons of ore, averaging 7.96 dwt. over 5 ft. A large proportion of this work was sinking, so that the amount of ore added to reserve is not so large as might otherwise be expected. The total ore reserve on December 31 was 485,585 tons averaging 8.4 dwt. over 46 inches. Arrangements have been made with the Victoria Falls & Transvaal Power Co. for an electric equipment for the mine. The workings are still shallow, the eighth level being the deepest that will be worked before the electric installation is completed. An interesting feature mentioned in the directors' report relates to the irregularity of the lode in the western part of the mine. At a depth of 430 ft. on the incline the lode suddenly became horizontal instead of dipping at 40°. Fortunately for the company this structure continued for only 270 ft., after which the lode dipped at 30°. This alteration in the formation makes it difficult to forecast the future resources of the mine, but it is expected that its life will be 9 years.



THE MINES ON THE WITWATERSRAND

formed in September last by the same group as the Jubilee for the purpose of acquiring and developing the Claremont and Nelly Extra properties in Rhodesia.

New Heriot.—This company was registered at Pietermaritzburg, Natal, in 1887, to acquire mines on the outcrop on the Rand. Milling commenced in 1888. A new plant of 40 stamps was built in 1893, since which time 30 more stamps and 2 tube-mills, together with cyanide plant, have been provided. The capital is £115,000 and since 1895 the yearly returns have averaged 70%. The report for the year 1910 shows that 185,484 tons was raised and, after the rejection of waste, 149,990 tons was sent to the stamps, where 41,109 oz. gold was recovered by amalgamation. The cyanide process recovered 17,722 oz., bringing the extraction to 58,831 oz., or 7.8 dwt. per ton milled. The cyanide plant also treated 28,710 tons of old dump and recovered 2892 oz. The total production for the year was therefore 61,223 oz. worth £258,516. The working cost was £152,141, leaving a profit of £107,504. The dividend absorbed £92,000. During the year 5596 ft. of development work was done, which dis-

City & Suburban.—This company was registered at Pietermaritzburg, Natal, in 1887, to acquire a mine on the Rand outcrop, and milling commenced in 1891. The capacity of the plant has gradually been extended until at the present time there are 160 stamps together with cyanide plant. Charles Glyn has been manager since November 1909. The report for the year 1910 shows that 382,454 tons was mined and, after sorting, 308,266 tons was sent to the stamps. The production was 56,299 oz. by amalgamation, and 49,740 oz. by cyaniding, a total of 106,049 oz., or 6.88 dwt. per ton milled. The revenue was £408,038, and the expenses were £308,484, leaving a profit of £99,553, out of which £10,262 has been paid as tax, and £68,000 distributed as dividend, being at the rate of 5% on the nominal capital. Until 1895 the shares were of £1 denomination, and during that year the capital of £85,000, in £1 shares, was expanded to £1,360,000, divided into 340,000 shares of £4 each. On the smaller capital 285% had been paid in dividends, and for the next ten years the dividends varied from 10 to 15% per annum on the expanded capital. For 1909 and 1910 the profits shrunk to 5%. During the past

million tons of 'reef' is exposed but is unprofitable. The ore raised during 1910 came from backs, pillars, and sweepers. Much of the above-mentioned ore reserve is in pillars and cannot be extracted until nearer the end of the life of the mine. Preparations are now complete for the commencement of sand-filling.

Rio Tinto.—The report for 1910 of this company owning the copper and sulphur mine in the south of Spain is as usual quite brief and bald. The divisible profit is £1,045,730, out of which £81,250 is distributed among preference shareholders being at the rate of 5%, and £937,500 goes to the ordinary shareholders, being at the rate of 50%, which compares with 60% for 1909. The amount of ore mined was 2,146,765 tons, of which 637,020 tons was suitable for shipment, whether valuable for copper or sulphur or both not being stated, and 1,509,745 tons was retained for local treatment, how much to be treated by smelting and how much by leaching not being specified. The production of copper during the year was 22,790 tons, and the amount of copper in pyrite shipped was 10,787 tons. The amount of copper produced at the mine during the previous year was 24,364 tons, and the reduction during 1910 is stated in the report to be due to a desire to help in "reducing the world's somewhat large stock of copper." The report also states that the demand for pyrite for sulphur content is increasing and is specially worth recording. No mention is made of the recent action against the company's neighbour the Pena, the result of which we gave in our last issue.

Broken Hill South Silver.—In previous notices of this company we have recorded that the new concentrating plant was completed at the beginning of 1909 but was not at once put into commission as the directors had not been able to conclude a satisfactory contract for the sale of the lead concentrate. After the settlement of this question later in the year, another period of inactivity was caused during January and February 1910 by the Australian coal strike. Some of the zinc tailing used to be sold to the Zinc Corporation, but since March 1910 the whole has gone to the De Bavay company to be treated on joint account. The Zinc Corporation and the De Bavay company are still treating old dumps. The report for the half-year ended December 31 last shows that the company is now in prosperous condition, and that nothing has hindered the continuous working of the mine and plant. The amount of ore raised was 179,117 tons, averaging 14·9% lead, 12·9% zinc, and 6 oz. silver. The concentrating plant produced 28,162 tons of lead concentrate, averaging 70·4% lead, 5·5% zinc, and 21 oz. silver, and 84,428 tons of zinc tailing, averaging 4·1% lead, 18·2% zinc, and 3·7 oz. silver. In addition 22,866 tons of slime was produced, averaging 10·7% lead, 12·1% zinc, and 4·9 oz. silver, stored for future consideration, and 43,760 tons of useless tailing, averaging 2·2% lead, 7·7% zinc, and 1·4 oz. silver. The zinc tailing was all dispatched to the De Bavay Co.'s plant, together with 11,548 tons from the dump, and 11,420 tons of dump material was taken by the Zinc Corporation. The developments in the mine during the half-year have been most satisfactory, and the reserve on December 31 was estimated at 3,000,000 tons. It is known in addition that large amounts of ore are in the mine between the 970 and 1070 ft. levels, but this is not yet blocked out. The company also has

1,199,000 tons of dump on hand, averaging 5·8% lead, 16·8% zinc, and 3·6 oz. silver, together with 238,675 tons of accumulated slime, averaging 11·8% lead, 14·7% zinc, and 5·8 oz. silver. The cost of mining, filling stopes, and development, was 12s. 8d., and of concentrating 3s. 6d. The income from the sale of lead concentrate was £212,591, and the receipts on account of zinc tailing £32,089. The net profit was £67,800, out of which £60,000 has been distributed as dividend.

TRADE NOTES

Most of the trade publications mentioned in this column are available for distribution and the manager of "The Mining Magazine" will be pleased to secure copies for persons interested.

The Griffin Company now represent the Robins Conveying Belt Company in San Francisco.

Fraser & Chalmers have issued a comprehensive bulletin describing the application of Rateau turbines to blowers, compressors, fans, and centrifugal pumps.

Diamond Boring Machines are illustrated and described in a catalogue issued by the Swedish Diamond Rock Drill Company.

The Universal Smelting & Refining Co. describe the Partridge hot-blast smelting furnace in a series of bulletins. They propose a rather unusual scheme to lease these smelters at a monthly rental price.

The Sturtevant Engineering Co. have maintained their high standard for well printed and excellently arranged bulletins in Section No. 84, devoted to the description of their Tube-Mills.

The Sullivan Machinery Co. of Chicago have opened a London office in Salisbury House. H. T. Walsh, who until recently was manager of their San Francisco branch, will be in charge.

The Dorr Cyanide Machinery Co. report recent sales of four classifiers and seven thickeners to the Dome Mines Syndicate, Forcupine, and one classifier and three thickeners to the Portland Mill at Colorado Springs.

Ironside Son & Dyckerhoff have sent us their catalogues describing their internal combustion locomotive. The details of engine construction are given, as well as cost, and the illustrations show installations already made.

The Dorr Cyanide Machinery Co. have just published a new catalogue, describing the Dorr Classifier and Dorr Thickener in detail. The illustrations show installations in various metallurgical plants. A long list of users indicates the wide adoption of these clever machines.

Steel Flumes made for carrying large quantities of water for hydraulicicking or irrigation purposes are fully described in catalogue No. 6 of the Western Hydraulic Mfg. & Supply Company. The flumes are semi-circular. The small sizes are supplied ready for bolting together, while the large flumes are made at the point where they are to be erected.

The San Francisco daily papers comment on the coaling call made by Dredge No. 508 built by William Simons & Co. of Glasgow, and destined for harbour work at Vancouver, B.C. Each bucket has a capacity of 28 cu. ft., and the dredge was propelled the entire distance from Glasgow under its own power, making seven calls for coal. A number of years ago a large Lobnitz dredge made the trip from Glasgow to Santa Rosalia, a port in the Gulf of California, and has since been in constant use by the Boléo Copper Company, dredging and removing the pulverized slag which accumulates inside the breakwater.

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Scientia non habet inimicum nisi ignorantem.

T. A. RICKARD, Editor.

EDGAR RICKARD, Business Manager.

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REVIEW OF MINING

INTERESTING.—Owing to the weather at Easter the holiday time was protracted and business temporarily became stagnant. To an American, who does not absent himself from his office even on Good Friday, our religious observance of recurrent intervals of relaxation is perplexing and in effect it does seriously diminish the number of working days in a year. We should be warned therefore that the impending Coronation will curtail the business to be transacted in June, for the festivities incidental to that great event will be preceded, early in the month, by the customary Whitsuntide recess. If the usual amount of business is to be done, the pace must be accelerated.

After Easter the markets were dull, owing to belated idlers, but a week thereafter an improvement appeared. The Mexican insurrection was largely discounted and only slightly affected quotations on Mexican railways or mines. The Shamva news helped Rhodesians. Later the markets became lifeless.

TRANSVAAL.—The March statistics, showing a record output of 676,065 ounces of gold, valued at £2,871,740, had a cheerful effect, coming after February, which, being three days shorter than March, had exhibited a yield 65,237 oz. less. Yet the average daily output in March was 7 oz. short of that in February. The difference is more than covered by the absence of a return from the Meyer & Charlton, which produced 4784 oz. in February, but was compelled, by shaft repairs, to suspend milling during March. The Rand is now producing gold at the rate of 8,000,000 oz. per annum. The labour returns show a gain of 4023 for the month and 15,112 as compared with the corresponding month last year. A decidedly favourable view was taken of the first return from a recently consolidated group,

the Randfontein Central. This includes the Randfontein South, which previously operated 400 stamps, and the Randfontein Central, with a new mill of 600 stamps, of which 300 are now at work. The 700 stamps crushed 179,188 tons for a yield of £233,860, the yield per ton being 26s. 1d., the cost 17s. 2d., and the profit 8s. 11d. per ton. This is good work.

The tonnage treated on the Rand in March was the highest on record, namely, 1,960,678. The yield was 27s. 7d. or about a shilling per ton less than in February, while the cost was 17s. 11d. or 4d. per ton less, leaving a profit of 9s. 9d. per ton—the lowest recorded during the past 12 months; yet the total profit, £949,415, is the highest this year and compares with £927,244 in April of last year.

The Robinson has had a good year, that grand mine having increased its resources by developing the low-grade ore of the Main Reef. During 1910 the proportion of Main Reef treated was increased from 12 to 37%. The profit was decreased by 5s. 3d. per ton, to 41s. 6d., but the working cost was reduced to 12s. 2d. per ton, which is much below the average on the Rand. The output consisted of 780,030 tons, out of which 18·4% was sorted, leaving 638,900 tons, yielding 315,376 oz. gold or 9·872 dwt. per ton. The Robinson now has 1,794,189 tons of 11·77 dwt. ore in the Leader and South Reef, together with 2,202,437 tons of 4·24 dwt. stuff in the Main Reef. In the latter case a stoping-width of 80 inches has been found economical. The profit for the year was £936,756, out of which dividends amounting to £825,000 were distributed.

Rumours of further consolidations are in the air; on the one hand there are mines that are approaching exhaustion and own

large mills for which ore must be found; on the other hand, several newly developed properties with plenty of ore are not provided with the necessary plant. Obviously a combination in such cases is advisable. Among the companies coupled in current gossip are the Ferreira and Ferreira Deep, in the Central Rand, and the two Vogelstruis companies, with the Roodepoort United, in the West Rand.

In the annual report of A. Goerz & Co. we note some remarks by the consulting engineer, Mr. William McC. Cameron, on native labour. He shows that at a representative mine of this group the total cost, including wages, recruiting, feeding, and expenses in the compound, has increased 1s. 2d. per ton milled in the last two years. The increase in wages amounts to 6s. 8d. per 'boy' per month, but it has not tended to improve efficiency. The companies operating on the Rand must come to an agreement on the matter. A private cablegram indicates a net gain of 1100 in native labour during April. Last year in the same month the gain was 5469. A poor mealie crop is facilitating the recruiting of natives, but an outbreak of fever in Pondoland is likely to interfere with any further supply from that particular region.

Tin mining in the Transvaal has been stimulated by the success of the Zaaiplaats, a company operating in the Waterberg district. Production commenced in February 1909, and up to the end of 1910 the output consisted of 32,500 tons yielding 2284 tons of concentrate containing 71% tin. Dividends amounting to 205% have been paid on a capital of £60,000. The ore exists in chimneys or pipes from 2 to 5 feet wide, with occasional enlargements to 30 feet. Twenty of these have been found and 67,617 tons of 8'55% ore has been proved.

We referred recently to the Messina copper mine. It is announced that the company is to be reconstructed with a view to raising ad-

ditional capital and pushing development. The Union government has undertaken to build a railway from the Silati line to the Messina and it is expected that this branch road will be ready in one year. The main shaft, which is 800 ft. deep, passed through the lode at 700 ft., showing ore still impregnated with chalcocite and bornite, thus indicating further persistence of the rich ore exposed in the upper levels.

RHODESIA.—The statistics of gold production for March exhibit some improvement, the gain being 6855 oz. as compared with February. The output for the first quarter of 1911 amounts to £642,905 as against £659,784 during the same period of 1910, so that no noteworthy advance has been scored. For March the Globe & Phoenix is again the leader with £38,981 from 6118 tons, this being a small gain in tonnage and a slight decrease in average yield. The Giant gave £20,238 from 12,050 tons, this being an improvement all round. The cost is creditably low, only 13s. 8d. per ton. The Gaika, Eldorado, Lonely, Penhalonga, Rezende, and United Rhodesia show no change. The Wanderer exhibits a gain. On the whole the figures suggest stability, rather than expansion.

On April 24 the price of Shamva shares responded to good news, it being announced that ore better than the average had been cut in three workings. At these places ore ranging from 4 to 20 ft. wide assayed from 11 to 26 dwt., as against the average content of the deposit, namely 4 to 5 dwt. per ton. Should these richer spots prove to be large they will sweeten the output so as to increase the profit to a notable degree.

The large deposit of banded ironstone in the Victoria district, about two miles from Eureka, promises to make a mine. Work done by the S.A. Prospecting & Concessions Syndicate at a depth of 100 ft. has disclosed 24 ft. of ore averaging an ounce of gold per ton. Unfortunately the deposit is in one of

the worst malarial regions and development will be hindered thereby, but it is evidently most promising.

Selukwe shares rose suddenly a couple of days before a telegram from the mine was published showing that another patch of ore had been cut, but the discovery has no special significance. A bunch of ore may make a Stock Exchange spasm but it won't make a mine. The Rezende sends some good news relating to development in the western workings. 70 claims out of 396 are being worked at present by the company. Ten stamps are being added to the 30 now in operation. Recent prospecting in the Gatooma district has culminated in the flotation of the Gem mine, which has one shaft 140 feet deep, showing 6 ft. of 8 dwt. ore. Mr. R. O. Weston reports favourably.

Mr. Robert Williams sailed for Cape Town on the 13th instant, on his way to the mines of the Tanganyika Concessions. That enterprise is now on the eve of its grand climactic. The blast-furnace of 300 tons capacity will be erected by the time Mr. Williams arrives at Katanga, and it is intimated that he may order two more furnaces. No mention is made of coke supplies. Meanwhile the reduction plant, the truly novel portion of the equipment, lies at Beira, and will probably remain there for a while, as the confidence in a great technical experiment seems to decrease in the near approach to a trial.

WEST AFRICA.—At the meeting of West African Mines, Lord Harris stated that good progress was being made on the Gold Coast in regard to organization and supply of food. The companies are being met by the Government in a sympathetic manner and a satisfactory settlement is anticipated. This matter was discussed at length in our issue of November last. The gold returns for March show a yield worth £67,673, which is the best monthly output since June. In the first quarter of this year the total yield has been

£196,861, as against £111,111 during the same period last year. Among the individual outputs we note improvement in the two dredging companies, the Ancobra and Offin River. The Prestea mill has made a start, but trouble with a pump has delayed crushing to full capacity.

The West African Trust, which had prospecting rights over the whole of the Himan Concessions on the Prestea Range, by the terms of their contract had to select half of the property on which to continue exploratory work, the other half reverting to the Himan. Upon the half now selected, eight blocks, the Trust has an option of flotation for the next three years.

The directors of the Abbontiakoon have decided, on the recommendation of Mr. Henry Hay, their superintending engineer, to increase the plant by the provision of 25 heavy stamps and 2 tube-mills, so as to bring the capacity to 11,000 tons per month. This plant should be ready by the beginning of 1912. During the past year the ore reserve has been doubled, and on December 31 stood at 414,949 tons averaging 11½ dwt. per ton.

AUSTRALASIA.—By the time these pages are in print the Waihi annual meeting will have been held, but we have no expectation that the directorate will be changed in accordance with a resolution to be moved at the instigation of a small group of New Zealand shareholders. Already the directors have received proxies representing 33,600 New Zealand shares, and it is understood that 70% of all the company's shares are held in England. The report to be submitted to the meeting gives no new information. Even Mr. G. A. Richard's findings have not been published, save in a cabled summary. In any event his report is not likely to meet the case, which calls for a detailed investigation by an expert geologist, such as Mr. C. W. Purington, from whom we publish an interesting letter. The management has shown lack of vigour and

initiative, but there is not the slightest reason for believing that the transfer of control to New Zealand would be any improvement. We shall be curious to see what justification is proffered for this extreme step, naturally distasteful to British shareholders.

The Waihi-Paeroa Gold Extraction Co. is undertaking to beneficiate the tailing accumulated in the Ohinemuri river after discharge from the stamp-mills of the Waihi, Talisman, and Crown mines. The estimated quantity of tailing available is 2,000,000 tons, supposed to average 9s. per ton, and to be treated for 4s. per ton. The sand is to be elevated by air-lifts into pontoons, then conveyed to tube-mills, followed by a vacuum-filtration plant, using the Moore filter. The equipment involves an expenditure of £80,000 and is to start work early next year.

Negotiations have been completed whereby the Zinc Corporation acquires the Broken Hill South Blocks. This purchase is prompted by the discovery in the South Blocks of a zinc lode parallel to the main Broken Hill lead lode and only three or four hundred feet away. The lode is from 10 to 20 ft. wide and has been cut at 900 ft. as well as at various levels overhead. The ore averages 20% zinc and 7% lead; thus it is brought within the purview of the Zinc Corporation. The purchase is made by exchanging the shares of the South Blocks for £66,000 in preference (ex. next 2s. 6d. dividend), and 200,000 ordinary shares of the Zinc Corporation. This places the price of South Blocks at 21s. 6d. apiece. This new move is of great importance, for it means that a company depending on old dumps and on royalties has acquired a mine for itself. We have always urged companies owning special processes to adopt this policy, and in this particular case the benefit will accrue to both the process company and the mine shareholders.

Developments at the Youanme mine have proved so satisfactory that it has been decided to form a company with a capital of £350,000

and to erect the first half of a 40-stamp mill. The mine is owned by three interests and the company now formed is required to define these holdings. No public issue will be made and no shares will be offered to the public until the property is placed on a dividend basis. Incidentally the name of the mine has been changed from Youanme to Yuanmi, but you and I, dear reader, need not worry about it.

We note that the Sons of Gwalia subscribed £25,000 or one quarter of the capital of the Northern Ontario Exploration Co.; and that the Ivanhoe subscribed £15,000 for the Yukon placer business shortly to be issued in London.

CANADA.—Among the engineers who have now visited the Porcupine goldfield are Messrs. William Frecheville, C. S. Herzig, A. F. Kuehn, Thos. H. Leggett, W. J. Loring, F. H. Minard, C. A. Moreing, F. J. Pope, Alfred Simon, H. H. Webb, Louis Webb, and Ernest Williams. Two of the gentlemen mentioned have contributed articles to this magazine and several others have given their views, from which we gather that the Dome, the Hollinger, and the Rea are promising mines, but that the district is the scene of exuberant wild-catting. The Consolidated Goldfields of South Africa has relinquished its interest in the Rea claims, accepting 20,000 shares in a company formed at Toronto to exploit this property. We note with interest that Mr. Malcolm Maclaren is about to make a geological inspection of this mining district. The Hollinger Gold Mines is sending reports of progress, by cablegram, to the financial papers; from which it appears that good ore is being developed on the 200-ft. level. As indicating the growing interest in Canadian mining ventures, the *Financial News* gives a separate list of quotations under the heading of 'Canadian.' Among them is the First New B. C. Goldfields, on which we commented adversely several months ago. Northern Ontario Exploration and its first subsidiary are both quoted at a premium.

UNITED STATES.—The Chino copper mine, in New Mexico, is expected to become productive before the close of the current year. This is one of the big disseminated copper deposits, no less than 45,000,000 tons of 24% ore having been developed, of which 70% can be mined by steam-shovel. A plant to treat 3000 tons daily is in course of erection.

Secondary enrichment of copper veins, as indicated by the presence of chalcocite, has now been proved to reach to the great depth of 2775 feet; for in the Speculator shaft, of the North Butte mine, in Montana, 5 feet of ore averaging 13 oz. silver per ton and 24% copper has been cut.

The Goldfield Consolidated output in March was 25,814 tons of ore, yielding \$1,040,000, out of which \$825,000 was profit. This is the third time that the monthly output has exceeded \$1,000,000 in value.

The completion of the hydro-electric power-plant of the Homestake Mining Co. will introduce further economy in an enterprise already famous for low operating cost. For the year ending June 1, 1910, the Homestake produced 1,237,381 tons yielding \$3'63 per ton.

MEXICO.—At the time when we go to press the situation is undergoing rapid changes. The resignation of President Diaz, if fulfilled, will remove one cause of irritation, but it remains to be seen whether General Madero can control the insurrectionary forces and persuade them to lay down their arms. If he can, the position will be much improved and an orderly election for President may ensue after a quiet interval. As we write the cable service is interrupted, but by mail we learn that among the victims to the disorder in Mexico is Thomas D. Murphy, formerly at El Oro and later manager of the El Favor mines in Jalisco. He was killed by a native. Among the many friends he made by unassuming kindness is the writer of these lines. Absolutely trustworthy and quietly capable, he commanded confidence and

won general esteem. A wife and a little son accentuate the tragedy.

The Santa Gertrudis mill of the Camp Bird company will be in full operation early in June, starting at the end of May. Some anxiety has been caused by rumours of litigation with the *avio* shareholders, but it is officially stated that nothing new has transpired since the annual meeting, when the chairman, Mr. A. M. Grenfell, explained the matter fully. We also described these old contracts in our issue of November 1909.

INDIA.—The attention of those interested in Indian mining has been centred this month on the Balaghat. This mine is the most northerly of the Kolar group, the Mysore being at the southern end. The reliability of the lodes is greatest at the southern part, and the persistence of profitability decreases as they are worked northward. The Balaghat has had a hard struggle. It was reconstructed three times before profits were made in 1900. For six years thereafter dividends were paid, and then has followed a period of depression. A year ago the outlook was gloomy. At the meeting of shareholders held this month the directors spoke in a much more hopeful strain.

SIBERIAN enterprises are prospering. The Russian Mining Corporation, in its last financial year, was able, chiefly by realizing on its holdings of Lena Goldfields, to earn a profit big enough to return its entire paid-up capital, together with a dividend amounting to 75% in cash. The company has been re-organized with five times larger capital. Lena Goldfields have been conspicuous in the share-market owing to lively dealings. These are due to the belated discovery, at St. Petersburg, that the shares of the English holding company (the Lena Goldfields) are not on a parity with those of the Russian operating company (the Lenskoie), and the consequent purchase of the cheaper share. To establish parity Lenas ought to be at £7, but that

seems an absurd price for a company that is paying dividends at the rate of 20% on its £1 shares. This, however, does not dispose of the matter, for there is the contingency, quite possible, that the Lena Goldfields company might sell some of its Lenskoie shares, of which it recently held 62%; and in that event the profitable winning of gold at the mine might become subordinate to the even more profitable process of selling shares that are over-valued; in short, Lena Goldfields represents not only an alluvial gold mine but a Russian industrial enterprise having several strings to its bow.

The acquisition by the Spassky copper company of a controlling interest in the Atbasar mines is announced, and it is proposed to increase the capital of the Spassky from £500,000 to £600,000 by the creation of 100,000 new shares. The decision to acquire a controlling interest in the Atbasar was adopted, in the first instance, on the suggestion of the French directors for whom Mr. C. Cerruti examined the property last year, at the time when Messrs. R. Gilman Brown and S. H. Ball also made their inspection. This event will strengthen the Spassky and establish the company as the chief industrial factor in southwestern Siberia. The community of interest between two mines exploiting deposits of such diverse character, one a contact vein marked by secondary enrichment, and the other an impregnation in a horizontal sedimentary formation, is calculated to give stability to both enterprises. The Spassky has been regarded as a relatively small high-grade proposition, and while the Atbasar is by no means low-grade it bears every promise of being an extensive deposit.

VARIOUS.—Two of the French gold mines publish annual reports. During 1910 the La Bellière mines produced 90,481 metric tons of ore, of which 86,140 metric tons was treated for a yield of 1206'264 kilogrammes of gold and 162'091 kilo. silver; this is equivalent

to an output of 84,784 tons avoirdupois crushed and a yield of 38,783 oz. gold and 5211 oz. silver, worth together 4,273,672 francs or £170,946. Arsenious acid was sold to the amount of £3992. After allowance for depreciation of plant, etc., the profit for the year amounted to 1,801,455 francs or £72,058. The ore reserve consists of 302,000 metric tons, an increase of 45,500 for the year. The mines of La Lucette sold antimonial ores to the extent of 1,600,939 francs, and gold ore and products for 2,439,331, the total production being worth 4,040,270 francs or £161,610, leaving a profit of 2,263,011 francs.

Several productive British enterprises are based on the mining of tin alluvium in the Malay States. Most of them are controlled by Cornish adventurers, using this term in its old sense. Of such companies the Tronoh is conspicuous as a complete success. To Mr. Harry D. Griffiths, the manager, much credit is due for excellent engineering methods and for economical administration. He appears also to have safeguarded the interests of his company by enterprising acquisitions of additional alluvial ground, thereby ensuring a long and profitable life to the enterprise. It is not often that business sagacity and technical skill are so usefully combined. During 1910 the Tronoh produced 2945 tons of tin concentrate (75% metallic tin) worth £271,304 from 410,777 cubic yards of gravel, indicating an average yield of 16 lb. of cassiterite per cubic yard. The profit at the mine was £89,792. The output comes from 17 shafts sunk to bedrock, at a depth varying from 140 to 180 feet. The gravel is hoisted in wooden buckets by steam. The Tronoh is a drift mine exploiting a lead from 50 to 150 ft. wide, for a length so far developed of half a mile.

We note with interest that Mr. F. A. Robinson, managing director for the Anglo-French Exploration Co., has become a director of Dolcoath, the premier mine of Cornwall.

STATISTICS

STATISTICS OF THE PRODUCTION OF GOLD IN THE TRANSVAAL MINE

Month	Production in Tons	Stocks at end of month	Value in Tons
January 1911	64,251	60,000	60,000
February	6,491	6,080	6,080
March	8,825	2,925	2,925
April	7,700	7,500	7,500
May	82,367	8,000	8,000
June	7,300	7,300	7,300
In Hamburg (estimated)...	11,000	10,000	10,000

AGGREGATE PRODUCTION OF GOLD IN THE TRANSVAAL MINE IN TONS OF 2,240 LB.

Month	Deliveries			Stocks at end of month
	Production	Domestic	Total	
January 1911	51,650	18,785	23,753	63,591
February	49,030	22,553	20,139	42,692
March	58,273	26,375	55,875	72,325
April	52,716	23,396	27,736	51,132

PRODUCTION OF GOLD IN THE TRANSVAAL MINE

Month	Kind	Value	Total	Value
July, 1910	Oz.	610,664	28,050	638,714
August	Oz.	623,129	26,140	649,269
September	Oz.	621,311	25,588	646,899
October	Oz.	627,445	25,147	652,592
November	Oz.	617,905	24,686	642,591
December	Oz.	616,668	24,327	640,995
Totals, 1910	Oz.	7,228,588	305,532	7,534,120
January 1911	Oz.	625,862	25,201	651,063
February	Oz.	585,683	24,965	610,648
March	Oz.	649,247	26,818	676,065

COST AND PROFIT ON THE RAND

Month	Tons	Yield per ton	Costs per ton	Profit per ton	Total profit
October 1909	1,868,718	s. d. 28 0	s. d. 17 9	s. d. 10 3	£ 952,161
November	1,800,371	28 6	18 0	10 7	951,773
December	1,827,423	28 1	17 9	10 5	952,574
January 1911	1,865,232	28 0	17 11	10 1	930,059
February	1,712,198	28 6	18 3	10 3	874,612
March	1,960,678	27 7	17 11	9 9	949,415
Totals and averages for 1909	20,543,759	28 11	17 1	11 0	11,794,376
Do to 1910	21,432,541	28 6	17 7	10 6	11,216,105

NETT'S EMPLOYMENT IN THE TRANSVAAL MINES

Month	Gold mines	Coal mines	Diamond mines	Total
October 1910	180,103	8,528	8,068	196,699
November	178,027	8,367	8,362	194,756
December	178,602	8,354	8,354	196,895
January 1911	183,268	8,357	9,991	201,616
February	189,434	8,513	9,814	207,761
March	193,457	8,493	10,061	212,011

GOLD OUTPUT OF INDIA.

Year 1909	Year 1910	April 1911	1911 to date
£2,083,901	£2,104,858	£176,263	£697,677

PRODUCTION OF GOLD IN EUROPE

Month	1909	1910	1911
January	199,388	199,388	207,903
February	191,635	192,497	203,888
March	202,157	202,157	228,385
April	212,915	222,700	228,213
May	223,807	223,807	231,947
June	224,920	217,600	214,709
July	228,151	225,234	195,233
August	228,296	228,296	191,423
September	204,262	213,249	178,950
October	223,653	223,653	234,928
November	196,668	236,307	240,573
December	217,316	233,397	199,500
Totals	2,526,007	2,623,788	2,568,201

PRODUCTION OF GOLD IN WESTERN AUSTRALIA

Month	1909		1910		1911	
	Oz.	Value	Oz.	Value	Oz.	Value
January	22,817	£ 91,112	17,357	70,699	15,903	66,107
February	21,403	86,210	16,976	68,469	15,179	63,081
March	23,186	93,556	17,627	71,954	16,387	67,673
April	21,491	88,074	16,069	67,069		
May	25,104	100,056	16,590	68,355		
June	17,340	70,561	17,194	70,988		
July	17,331	70,523	17,194	58,551		
August	17,766	71,614	13,921	57,713		
September	18,125	72,963	11,497	47,746		
October	15,957	65,813	13,341	55,046		
November	17,882	73,824	14,021	57,658		
December	17,570	71,332	15,042	61,737		
Totals	235,972	955,635	185,493	755,985		

PRODUCTION OF GOLD IN WESTERN AUSTRALIA

Month	Export	Mint	Total	Total
	Oz.	Oz.	Oz.	Value
Total, 1910	363,496	1,209,856	1,573,352	6,682,042
January 1911	17,463	102,035	119,498	507,592
February	22,047	84,991	107,038	454,666
March	12,296	93,267	105,563	448,426
April	20,455	91,791	112,246	476,787

PRODUCTION OF AUSTRALASIAN GOLD

Month	1909	1910	April 1911	1911 to date
	£	£	£	£
Queensland	1,916,468	1,840,337	149,700*	367,610*
New South Wales	869,546	803,727	50,555	229,340
New Zealand	2,006,910	1,896,322	74,659	545,302
Victoria	2,897,340	2,422,700	226,160*	517,560*

* March figures only.

SALT PINE CONCENTRATE AT KILBURN, ILLINOIS

Month	Tons	Value	Amount
April 1911	1,002	£23,694	£118 18 4
May 1911	1,002	£30,313	£118 18 4

REPORTED BY A. STRAUSS & CO.

Month	April, 1911	1911 to date
	tons	tons
Metal from Straits to Europe and America	3,115	16,212
Metallic Content from Bolivia to Europe...	1,552	6,960

EDITORIAL

WE ARE INFORMED that Messrs. Richard A. Varden and Arthur Wilkinson, owing to residence abroad, have ceased to be resident members of the Council of the Institution of Mining and Metallurgy and have been transferred to the list of corresponding members of council. The two vacancies thus created have been filled by the selection of Messrs. Henry C. Taylor and Edmund W. Janson. The selection is excellent and will add to the effectiveness of the Council.

ARRANGEMENTS for the transfer of the Mining and Metallurgical Club to the City are progressing satisfactorily. The lease for the new quarters at 3 London Wall Buildings has been signed and the decorators are now at work. The rooms will be ready for the furniture by June 3, and on or about June 12 it is proposed to have the formal opening. Subscriptions toward the furniture fund are coming in fairly well but it is hoped that members who have not subscribed will do so without delay. The Club ought to prove a great benefit to the members of a nomadic profession, giving them a comfortable rendezvous in the heart of the financial district.

REVOLUTIONS have been so much in the air, both as a figure of speech in English politics and as a stern reality in Mexico, Morocco, Portugal, Brazil, and Nicaragua, that the record of a mining engineer's personal experiences during one of these periods of unrest is likely to prove interesting. Mr. R. H. B. Butler, who tells his story in this issue, is a young British engineer who has served an American apprenticeship and evidently possesses excellent powers of observation. We hope that among our many readers in Mexico one of the younger men

may send us an equally vivid description of how they do things in the land where things have been, until recently, a *cuestion de Dias*.

AT the time of the last annual meeting of the Mexico Mines of El Oro it was announced by Mr. R. T. Bayliss that he was bringing an action for libel, founded on a letter of S. Pearson & Son to the secretary of the Mexico Mines Company. In that letter Mr. Bayliss held himself to have been slandered, his attitude as regards the prospects of the mine having been imputed to improper motives. On April 11 the suit came up before the King's Bench and it was announced by counsel that it had been withdrawn, an apology having been tendered by the defendants, S. Pearson & Son, who disclaimed the interpretation put upon the letter by the plaintiff and stated that they had never questioned his personal honour or integrity. And so the episode ended in a manner creditable to both. We deplore reckless litigation, but we commend a professional man for protecting his honour by legal action when it is necessary.

BY the death of Peter Watson the Cornish mining industry loses one of its chief supporters. At one time he was able to boast of being a shareholder in 250 different mines in the old county. As chairman of Devon Great Consols he was connected officially with an historic enterprise in the adjoining county, but his interest did not cease here, for he was connected with mines in Wales, Scotland, and the Isle of Man. He was conspicuously just to employees and enjoyed general regard among mine captains by reason of his loyalty to them as long as they did their duty. His invincible optimism cheered them and served to stimulate Cornish mining in its dark days.

In his personal relations he was lovable, adding frankness to gentleness, and courtesy to a high order of intelligence. He attained the age of 81 and died rather suddenly, but peacefully, after a career full of generous effort and useful endeavour.

ANNOUNCEMENT is made that Dr. R. W. Raymond has resigned as secretary of the American Institute of Mining Engineers and is succeeded by his present assistant, Mr. Joseph Struthers. Dr. Raymond does not, however, sever his connection with the organization to which he has devoted so many years of his useful life; he becomes Secretary Emeritus, continuing to perform editorial and other duties appertaining to the office from which he resigns. The event, therefore, is not so greatly to the detriment of the Institute as it may appear at first sight. The general effect is to give official recognition to an arrangement already, we believe, in operation. During recent years Mr. Struthers, who is admirably qualified for the duty, has been acting as assistant to the Secretary, relieving him of the routine work of the office. Dr. Raymond's personality is so commanding that even as Secretary Emeritus he will, no doubt, continue to guide the policy and direct the general conduct of the Institute. We refuse to anticipate the day when his forceful and fruitful service is withdrawn from a society to which he has given so large a part of his beneficent career.

WE REFER to Mr. Sulman's presidential address elsewhere. It is strong enough to withstand a little criticism. Like many other technical men, Mr. Sulman uses the plural carelessly. For example, the new processes now in use at Broken Hill yield two distinct metallurgical products, namely, a concentrate rich in zinc and a concentrate rich in lead. The whole purpose of the treatment is to concentrate the two metals into two separate products, which are then sold on different

markets. Obviously, if the word 'concentrates' is used to designate both one and two of these products, the chance to differentiate is thrown away. Thus Mr. Sulman speaks of "zinc concentrates" when he means the special concentrate valuable for its zinc. To make matters worse, he occasionally uses the singular, thus: "The general result is the recovery of zinc concentrates, which, according to the process adopted, and the after treatment of the concentrate, may vary from 44 to 49% of zinc, together with substantial values in lead and silver." Later, speaking of "the main zinc product," he says that "these concentrates" are bought by European smelters. "These concentrates" might include the product rich in lead, but "this concentrate" would obviously refer to "the main zinc product." We trust we shall be absolved from pedantry. Mr. Sulman, as president of a technical society, fully appreciates the value of precision, and therefore we need not apologize for commending to him the use of the plural in a precise and significant manner.

INTEREST in Porcupine has been stimulated by the issue of the Ontario Porcupine Goldfields Development Co., an enterprise endorsed by Bewick, Moreing & Co. The company has been formed to acquire 50 claims on which an option had been secured by the Northern Ontario Exploration Co., as one of the first results of Mr. C. A. Moreing's recent visit to the goldfield. The property consists mainly of holdings heretofore belonging to the Timmins brothers. No detailed report is given, because, presumably, no work has been done on these claims, although systematic preparations have been made. If the prospecting proves successful, the ground will be divided among subsidiary companies. The price is £480,000, of which £50,000 is in cash. We note that Bewick, Moreing & Co. are to be general managers. This is well; but we consider that the prospectus is faulty in not giv-

ing their opinion as engineers. This, of course, may be inferred from Mr. Moreing's presence on the board, but even taking this for granted, it would have been well to give explicit information, such as must be available. The prospectus merely gives a few general data regarding the Porcupine goldfield as furnished to the directors by Mr. Louis H. Timmins, one of the original claim-holders. This is interesting, but not at all convincing. Mr. Moreing is known in London, Mr. Timmins is not. The British public should be given information by Mr. Moreing, who occupies a responsible position, and not by Mr. Timmins, who is unknown, save as an enterprising and honourable prospector.

SEVERAL attempts have been made to get behind the award in the Transvaal stope-drill competition of 1909 and to claim extra credit thereby for one or other of the two winners, the Holman and Siskol drills. These were bracketted equal and divided the first and second prizes. The competition committee found that the Siskol "drilled more footage [than the Holman], but cost more for spares, but the costs per foot drilled were so remarkably close that it was considered that the machines could fairly be said to have tied." It is claimed for the Holman that it cost less to operate, namely, 9'77 pence per foot as against 9'9 pence for the Siskol. This is true. On the other hand the price of spares is set down at £74. 10s. for the Siskol and £24. 11s. for the Holman, while the drilling speed was 0'818 inch per minute for the Siskol and 0'742 for the Holman. The Siskol people now explain that the price of spares as quoted for the competition was 30% too high, and that they are supplying drills to the Crown Mines under a contract to keep them in repair and supply the necessary spares for 25s. per drill per month. Desiring to be fair to both of the manufacturers, and to imitate the conspicuous justice of the competi-

tion committee, we venture to say that the competition is now an old story, both drills having been improved in detail since 1909, so that any mining company desirous of investigating the matter would do well to test both of the improved machines side by side. The competition served to stimulate the ingenuity of the designers of these machines, it proved that reciprocating drills were superior to hammer-drills for down holes, that it is possible with small machines to break ground as cheaply and keep stopes as narrow as when doing the work by hand, and that hollow steel was unsuitable to conditions as they exist on the Rand. The subject is one of vital importance to the mining industry of the Transvaal and we hope to chronicle further advance toward the employment of a stoping-drill that will replace hammer-boys in all narrow stopes. The possibility has been foreshadowed, the actuality is yet to be attained.

COMMENTING upon the Ivanhoe annual report, several of the daily papers make a point of referring to the difference in the ore reserve as estimated on the one hand by the general manager and on the other by the consulting engineer. The difference is, we consider, not at all remarkable, having regard to the difficulty of a close appraisal in lodes so irregular in their enrichment as those at Kalgoorlie. Only lately we had the engineer to one of the big mines cabling that a reliable estimate was impracticable. This savours of an avoidance of proper responsibility and goes to the other extreme. At the Ivanhoe the manager places the reserve at 985,036 tons of ore having an assay-value of 44s. 10d., while the consulting engineer puts the figures at 1,089,463 tons and 45s. per ton. Two separate estimates would be unlikely to agree more closely, for the difference in tonnage amounts only to 10% and the difference in assay-value is negligible. The inclusion or

exclusion of a single doubtful block of ore would readily account for the discrepancy. It may be said in round numbers that the Ivanhoe contains 1,000,000 tons of 11 dwt. ore. Indeed we deprecate the using of decimal points and of pennies in giving averages for such approximations, because the ordinary shareholder is thereby induced to infer a precision that is impossible in estimates of this kind.

AT the Van Ryn Deep meeting held recently at Johannesburg, a shareholder made a plea for the holding of the annual function in London or for a confirmatory meeting at some European centre. He drew attention to the fact that only seven persons besides himself constituted the audience when the Van Ryn Deep directors met in public conclave and that the names of the same seven gentlemen appeared in the newspapers as performing a similar duty at other company meetings held in Johannesburg on the same day. He complained that this tended to throw uncontrolled power into the hands of small groups, chiefly the original vendors, and at the same time created general apathy among the main body of shareholders, who had furnished the capital with which the controlling houses had risen to fortune. He therefore advocated the holding of dual and contemporaneous meetings, at Johannesburg and at London, or in the capital of the country where the majority of shareholders resided. We give these suggestions for what they are worth. They merit consideration. Public meetings, properly conducted, at which interesting information is frankly given, do tend to give stability to the shares of a mine and often render such shares a popular 'investment.' Good administrators do not fear to meet their constituents face to face and capable directors find their position strengthened by the annual *conversazione* at which the shareholders have a chance to ask questions. The average man who puts his

money into a mine likes to have an occasional say and he resents being regarded as a negligible pawn in the game of finance. At a time when Rand mining speculation suffers from dulness, those in control can afford to consider such suggestions. For our part, as onlookers, we have a vivid impression of the interest created by the speeches of Sir Julius Wernher at the Central Mining meetings, by the remarks offered by Mr. Lionel Phillips before the shareholders of Rand Mines, and by the annual review submitted by Lord Harris to his constituents in the Consolidated Gold Fields. Every chairman cannot talk as good sense as these three leaders, but every chairman should have a try. The interest, if not the gaiety, of life would be enhanced thereby.

THE LONELY REEF issues its first annual report, showing results highly creditable to the management and to Mr. C. B. Kingston, the consulting engineer. The information, however, is incomplete. Thus the recovery during the year has averaged 15.3 dwt. per ton, on 15,173 tons of ore. But the extraction is not stated. As the residue is credited with 4 dwt. per ton recoverable, which we assume to be equal to about $4\frac{1}{2}$ dwt. assay-value, it may be inferred that the extraction during the year averaged 80%. Whatever it was, it should be frankly stated, with the necessary explanation. The total expenditure was £29,250 on an output of 15,173 tons, so that the cost per ton was slightly over 38s., including 14s. 6d. for administration and depreciation. The latter is an item often overlooked in estimating the present value of ore reserves; it is habitually disregarded by people who assume the profit to be indicated by subtracting the operating cost from the assay-value. However, it is only fair to add that in the case of the Lonely there is no room for misunderstanding because the consulting engineer clearly refers to the "recoverable value" of the present ore reserve, he deducts the working cost, and

then gives the estimated profit. The reserve includes 77,434 tons, therefore the total working cost of £88,508 means slightly less than 23s. per ton. This is on the basis of a larger output and reduced expenditure. As the 'recoverable gold' is estimated at £350,919 and the ore reserve consists of 77,434 tons of 22'77 dwt. ore, the extraction is evidently calculated at 95%; which seems an optimistic estimate. The total profit assured—£262,411—represents 27½% on the market valuation of the mine, at a price of £3½ per share for the 271,000 shares issued. As an 'investment' the mine is not attractive at the current valuation because the improvement in milling, the reduction of cost, and the larger output have all been discounted; but as a 'speculation' the enterprise is interesting. Mr. Kingston's report shows that stoping has been confined to the ground above the second level, and that four other levels have been extended in ore averaging better as depth has been gained. At the sixth level, the lode is 54 inches wide, assaying 67'7 dwt., where exposed in the cross-cut from the main shaft. The mine is young and the report covers only the first year of operation, therefore we are not inclined to criticize the estimates of cost and extraction, but it is obvious that they ought to be given more explicitly, for without a clear pronouncement on these matters the other figures are obscured. Evidently this mine is a young and growing enterprise of great promise.

Royal School of Mines.

The annual dinner on May 4 was a function that fulfilled more than a merely convivial purpose. It was remarkable as evincing for the first time a real goodwill between the old students and the officials connected with the educational institutions at South Kensington; that is, it marked the passing of the acute jealousy felt not many years ago by the Royal School of Mines men against any and all of the cognate colleges among

which it seemed destined to be smothered. That jealousy was the expression of loyalty to an *alma mater* and it deserved some respect, such as in the end it received cordially from the constituted authorities. The chairman at the dinner, Sir Thomas H. Holland, a distinguished public servant, himself typified the *rapprochement*, for while a graduate from the College of Science he has ever been in sympathy with the School of Mines, and in his admirable speech he gave expression to sentiments completely disarming even to the more violent partisans of the R. S. M. Mr. A. H. D. Acland, of the Board of Education, and Sir Alfred Keogh, Rector of the Imperial College, both referred to the Royal School of Mines, its traditions, its needs, and its future, in terms obviously sincere and therefore convincing. The hatchet was buried, the calumet of peace was smoked, and as if further to establish an era of mutual co-operation, Mr. H. L. Sulman, as president of the Institution, laid emphasis on the fact that while the Institution had taken a large part in the movement to re-organize the mining department at South Kensington, that movement, after all, owed much of its momentum to the School of Mines men who formed the backbone of the Institution. Thus the alumni have done something besides meeting annually to dine, to wine, and to talk. It is true the bulk of the money for the equipment of the new Mines building has been subscribed by Sir Julius Wernher and his deceased partner; but many School of Mines men contributed to the Bessemer Memorial fund, out of which a large grant was made for the new buildings in which the mining department of the Imperial College is to be housed. Yet the men who may reasonably claim to be directing the exploitation of the mineral resources of a world-wide Empire might reasonably have been expected to do even more for their *alma mater*. Now comes an opportunity to do it. In his speech Mr. Acland referred to the

building to be erected for the Students Union and he laid stress on its utility in bringing past and present students together. It ought to promote a solidarity and an *esprit de corps* now somewhat lacking, despite speeches and dinners. An appeal for funds has been made and there has been some response. One speaker referred with pride to the amount already subscribed, but we forbear from quoting the sum of money mentioned lest our friends in Canada and America should wax sarcastic. Old students of the School of Mines ought to be true to the noble traditions, if not to the Royal name, of the college from which they graduated; let them put their hands into their pockets in no niggardly spirit. Miners are proverbially generous; shall it be said that graduates of the premier School of Mines in the British Empire are found wanting at this time? The Students Union affords them an opportunity to express their loyalty in terms that can be appreciated. There are times when money is eloquent. We transmit the appeal to the Royal School of Mines men on the frontiers of empire and in the waste places of the earth. Send a subscription cheerfully and send it promptly, addressing yourself to Mr. Arthur C. Claudet, 6 Coleman Street, London.

Flotation Processes.

The announcement that the Minerals Separation Company is ready to do business in the United States marks an interesting epoch in the history of the flotation processes. It is signalized by the formation of a company incorporated under American laws, with Mr. E. H. Nutter as manager. This method of concentration has hitherto received but little attention in America, chiefly because no one skilled in such operations has been on the spot to demonstrate the application of the principle involved. This disadvantage has now been removed, and metallurgists on the other side of the Atlantic will have an opportunity of judging for themselves. Concurrently with the es-

tablishment of an American branch of the Minerals Separation Company, the *Engineering and Mining Journal* publishes an editorial in its issue of April 25, attacking the validity of flotation patents in general, and of those of the Minerals Separation Company in particular. The *Journal*, after maintaining for five years an attitude of incredulity as to the practical value of a new-fangled notion, now shifts its ground, and argues that the same thing was done twenty years ago in the United States. Thereupon it recommends American metallurgists to go ahead for themselves, and not be frightened with threats of litigation on the part of the proprietors of the process now introduced to their notice. We abstain from making more than passing reference to the personal considerations that may explain this unfriendly attitude toward Minerals Separation, merely ejaculating, with Mr. Vincent Crummies, of immortal memory: "How *do* these things get into the papers"! How indeed! It is not for us to say. But seriously, and on general principles, we wish to warn American metallurgists that the history on which the article in the *Journal* is based is incomplete and the application inaccurate. In our issue of September 1909 we published a detailed account of the various patents from 1860 onward, covering the selective action of oil, and the flotation by gaseous bubbles, oil, and surface tension, and we recommend American metallurgists to read this article for themselves. A careful perusal of it will show that the subject is much more complicated than the editor of the *Engineering and Mining Journal* would have it supposed. Of course, all these old attempts to utilize oil, acid, bubbles, etc., were perfectly well known to Elmore, Cattermole, and others who have applied themselves to this branch of metallurgy. For instance, Elmore only claimed the application of the principle to a freely flowing pulp, that is, he considered his invention to consist in the continuity of the process and in the use of

large volumes of water. This claim was, however, not upheld in the English courts, although the German Patent Office recognized its novelty; while in Australia the decision of the law on the subject has not yet been reached. The Minerals Separation Company, which owns the series of patents of Cattermole, Sulman, Picard, and Ballot, bases its main claim on the use of minute quantities of thin oil for the purpose of creating the froth that collects and buoys the sulphide particles. Both of the belligerent groups have patents for modern applications of an old idea, and their patents will cause trouble to those who wish to work the processes on their own account. So we recommend American metallurgists not to be in a hurry to follow the *Journal's* advice.

An editor may have some difficulty in deciding which line to follow: whether to fight for the perfect freedom of every process and so benefit metallurgists and operators generally, or to appeal for fair play to the individual metallurgist, who by years of thought and hard work has evolved a commercial process out of a chemical or physical idea. His decision is usually made according to the degree of reasonableness on the part of the inventor. If the inventor is too grasping, general resentment is aroused; but if he is reasonable in his demands, he ought to be allowed a legitimate reward. In the case of flotation processes, the owners are not avaricious; their terms of royalty and co-partnership are quite businesslike. There remains a further reason for recommending metallurgists not to embark rashly on the sea of investigation and invention for themselves, namely, the complexity and obscurity of the physical forces that underlie the phenomena of flotation. By all means let them make examinations of the problem, for we want more light on it—and less heat—both from scientific and practical men. But our advice is that they should not do it at the expense of a mine, for it will come

cheaper to engage the services of an expert, who has had a few years of experience, and to pay him a reasonable royalty, than to spend time and money on research work in the hope of evolving a commercial plant that will dodge the payment of a small royalty.

There is another feature of the *Engineering and Mining Journal's* advice that is open to objection. The question of the validity of patents is entirely one for the courts to decide, and it is useless for an editor to pass an opinion as to the legal standing of the various patents. If an editor has information that will help in the elucidation of an intricate dispute he is fully justified in publishing it, and in giving his interpretation of it, but to present an incomplete statement that practically evades the main question is only a trespass on the legal domain. In this connection it has to be remembered that several lawsuits are about to be tried in Australia and for this reason alone one-sided statements and comments by influential papers, though published on the other side of the Atlantic, are to be deprecated. The *Elmore v. Minerals Separation* case will be commenced on May 22. The Potter Company, which has the rights to hot acid solutions, is also bringing action against Minerals Separation. As for the *De Bavay Co.*, nearly all the other patentees claim that its process, though not necessarily its patents, is an infringement of their rights, therefore we suppose that it would be to the interest of this company that every patent should be upset in Australia, America, and elsewhere.

Tanganyika Concessions.

The formation of another subsidiary company by the Tanganyika-Congo group adds one more thread to a complicated web of mining finance. The *Compagnie Minière de Kundelungu* is the company formed at Brussels to exploit diamonds and other minerals, with a capital of 2,500,000 francs, of which one half is subscribed by the Tanganyika Concessions.

To the casual observer the last mentioned company had already bitten off more than it can comfortably assimilate, but apparently the energy of Mr. Robert Williams and his friends knows no limits. Not many men in London can explain the financial relations of the various enterprises organized to exploit the mineral deposits in the region traversing the northern border of Rhodesia and the southeastern portion of the Congo Free State. We shall not venture to do so; we can only suggest some of the relations existing. Thus the Tanganyika Concessions holds 45% only of the Union Minière du Haut Katanga, a Belgian company, which controls the Star of the Congo mine, the chief asset. On the other hand the copper mine at Kansanshi in Northern Rhodesia is the property of the Rhodesia-Katanga Junction Railway & Mineral Co., in which the Tanganyika Concessions holds a 75% interest. The Tanganyika Concessions has a capital of 1,000,000 shares of £1 each, of which 808,581 have been issued. These are now quoted at £4½, so that they represent about £3,500,000. Quotations for these shares have ranged from below £2 to above £26, so that fortunes must have been made and lost as a preliminary to producing copper. Besides its shares this company has three issues of debentures, amounting in all to £2,420,000, the bulk of the indebtedness being a charge on the Benguela Railway Co. and on the shares held in the Union Minière. Later borrowing has been effected through the medium of the Zambesia Exploring Co., another subsidiary. Furthermore the Tanganyika Concessions has been financing the Benguela Railway Co. and the Rhodesia-Katanga Junction Railway & Mineral Co., the latter now earning a profit, thanks to the traffic created by the transport of supplies and machinery for the copper mines. Thus the various companies help each other and are dependent on each other to such an extent as to drive an accountant

to despair. The entire position will be solved if copper can be produced on a large scale and profitably; it will be wrecked amid hopeless confusion if the technical management has made any serious blunder.

Wernher, Beit & Co.

Several of the daily papers, notably the *Pall Mall Gazette*, have devoted large space in their financial columns to unfavourable comment on the transfer of Wernher-Beit holdings to the Rand Mines company. We believe that too much has been made of the episode and that wrong interpretations have been placed upon it. Our understanding is that Sir Julius Wernher, on account of age, more than sufficient fortune, and lack of sons to succeed him in his administrative work, is desirous of shedding some of his large responsibilities. The position of Mr. Friedrich Eckstein is somewhat analogous, for he also is withdrawing gradually from active work. Naturally the retirement of one chief and the withdrawal of another must lead to re-organization. First the undeveloped properties in the Transvaal owned by Wernher, Beit & Co. were transferred to the Central Mining & Investment Corporation. Then the holdings of the firm in a group of partly developed and successful mines were transferred to the Rand Mines, by an exchange of nine large blocks of shares for 207,999 shares in Rand Mines. The price of those given and the price of those taken was alike based on the mid-February making-up price on the London Stock Exchange. Manifestly if Wernher, Beit & Co. had undertaken to sell their large holdings in City Deep, Crown Mines, East Rand Proprietary, New Modderfontein, Main Reef West, Village Deep, Modderfontein B, Bantjes, and Government Gold Mining Areas, the market quotations would have wilted and they would have obtained a price lower than that current recently; but, on the other hand, if the directors of Rand Mines had undertaken to

purchase these large blocks of shares on the open market their move would have been attended by a rise so that the purchases could not have been consummated at the current price. If, therefore, it be allowed that the mid-February price was fair to both sides of the bargain, we see nothing to do but to commend the good sense shown in the transaction. No reason exists for impugning the good faith of those concerned. The life of the Rand Mines and the stability of that company are alike enhanced by a large and valuable acquisition of property, some of which is highly productive, while other portions will yield dividends at an early date. Since some of the Rand Mines subsidiaries—such as Rose Deep, Geldenhuis Deep, and Ferreira Deep—have brief lives, it is obvious that the new blood must make for financial vitality. If the critics to whom we refer had attacked the first deal, by which undeveloped properties were transferred to the Central Mining Corporation, we might have appreciated their objections; but they did not. They waited, and reserved their strictures for a thoroughly creditable piece of business. Viewing the matter without prejudice it seems to us that a little more frankness on the part of Sir Julius and his associates would have prevented much of the misunderstanding that ensued; if the facts had been stated, the market would have been jarred, of course, but only for a day or two. After that the position would have been accepted as perfectly reasonable and not necessarily detrimental to the business based on the mining industry at Johannesburg. It now looks as if the Rand Mines and the Central Mining Corporation between them would take over the business and administration previously controlled by Wernher, Beit & Co., and that the able staff employed by that firm would eventually be transferred to the two companies mentioned. Thus while the personalities identified with the name of Wernher, Beit & Co. may cease to be important factors in mining

finance, the organization created by that firm will be perpetuated under the leadership of Messrs. Louis Reyersbach, Lionel Phillips, R. W. Schumacher, Charles Rube, Ludwig Wagner, and other men of conspicuous ability. In the end the mining industry and the public generally will have no cause to complain. The particular conditions amid which Alfred Beit and Julius Wernher rose to greatness have passed; they did splendid work, and they have written their names on South African history. New conditions call for new men, for a less personal administration, and for a re-adjustment of interests. It is wise to accept the inevitable with cheerful equanimity.

Mining Speculation.

In this issue we begin the publication of a series of articles on the finance of mining by Mr. M. H. Burnham, an engineer of wide experience, and in our last issue we gave our readers a letter on mining speculation written by a financier deeply versed in such matters. It is a pleasure to present different aspects of so vital a question, for it is not our expectation, nor our purpose, to proffer off-hand solutions of a problem in which so many unknown factors are involved. We do expect, however, to kill some nonsense and to collect some ascertainable facts, to the end that the public seriously interested in mining may at least avoid unnecessary blunders and lessen the losses due to errors not entirely avoidable. Our readers will have enjoyed the letter of 'A Director'; it breathes an air of good sense and practical politics, it bears the impress of a man of affairs fully desirous of improving workaday conditions while recognizing the impossibility of a millennial dispensation. No formula surely will express the permutations of business in the City and we appreciate his objection to any attempted technical short-cut. For instance, he will be one of the first to demur to Mr. Burnham's equations, but, being himself a scholar, he

we agree that such formulae are diagrammatic statements of thought, just as a chemical formula expresses merely the outlines of a metallurgical process. Many people are inclined to take chemical formulae too literally and we have seen instances, in geological discussions, for example, where intricate reactions have been so crudely expressed by chemical symbols as to mislead the student. Just as in chemistry the presence of water is taken for granted when stating equivalents so also in the business of mining the pervasive presence of the human element must not be overlooked. Indeed, an even closer parallel is possible, for 'water' spoils many a financial equation. Mining is an industry based upon the joint application of business and science; it is just as great a mistake to assume that the business can be effected successfully without science as it is to suppose that technology will suffice to win money out of an ore deposit. It is our *metier*, in conducting *The Mining Magazine*, to bring the business man, that is, the financier, into sympathetic touch with the scientific man, that is, the geologist, engineer, and metallurgist. Occasionally men are employed combining the qualities required for both sides of the industry, and such men serve as links between types often too divergent to appreciate each other.

While, therefore, we recognize 'A Director's' viewpoint, we also understand an engineer's requirements. For instance, the basic principles elucidated by Mr. Burnham can be illustrated by a formula simply because any logical ratiocination can be expressed in terms of mathematics. It is not to be supposed that a mine is bought on the basis of a slide-rule or of a bookish formula, but it is supposed that the appraisal of a mining property is made on reasoned principles, which pay proper regard to the conditions governing financial success. The applicability of any scheme of valuation depends upon the character of the evidence available. The appraisal

of a new discovery or a prospect hole involves so many unknown factors as to preclude nice calculations, and, under such circumstances, a professional opinion is based chiefly on judgment rendered instinctive by experience; on the other hand, the estimation of a developed mine containing a regular orebody, such as the Rand banket, may be based on so many accurately ascertainable facts as to become a precise statement. But even in that case all the facts are not known; some are lacking. This is where many mistakes have been made, not only by the untechnical public. While the Main Reef series is more uniform in contents and structure than the veins from which gold is won in other mining regions, it is subject to faults, intrusions, impoverishments, and other disturbances; to which must be added the perturbing influences that affect exploitation, such as labour troubles, political complications, and market manipulations. Thus even in Rand mines an element of risk obtains. This truism was formerly ignored and any emphasis that we have placed upon it can only bring into relief the comparative stability of industry on the Witwatersrand. In Mr. Burnham's article it will be noted that the allowance for risk looms large. Those who understand the business of mining have, of course, had this idea at the back of their heads, even if they have not made precise provision for it when negotiating the purchase of mines or shares. Thus the real investor who expects 5% net, after amortization, from a standard Rand security is asking more than the average bank-rate simply because he recognizes the inherent risk involved in all mining. Obviously, if 2% be enough to cover the risk in the case of Crown Mines or East Rand Proprietary, it is much too little for most forms of mining enterprise. For instance, if we may be permitted to write last year's almanac, it is apparent now that holders of Waihi shares at £10 ought to have allowed

a risk-rate of fully 25%, because the £10 valuation discounted the future favourable development of the mine to an entirely unwarrantable extent. Again, take the case of Goldfield Consolidated, the big mine in Nevada, which last year paid \$7,118,271 in dividends, on a capital of \$35,583,670, returning 20% on its nominal capital and 28% on the recent market valuation. This seems handsome indeed, but it is by no means too much, for it is estimated that the ore exposed in the mine is only equal to two years production at the current rate. Moreover, the orebodies at Goldfield, although unusually rich, are so irregular in their behaviour as to invalidate the assumption that they will persist indefinitely. In this case therefore a risk-rate of 25% is not at all too much, which is equivalent to saying that the shares cannot be regarded as an investment; they may afford a promising speculation, but they are quite outside any reasoned system of appraisal. No system ever helped a gambler.

Ventilation in Mines.

In our last issue we gave a précis of a paper on mine ventilation read by Mr. Frank Reed, of the New Zealand Mines Department. He advanced the reactionary argument that the recent laws promulgated or suggested in Australia and the Transvaal for the purpose of fixing the maximum amount of carbonic acid in mine-air have been carried to a wholly unnecessary extreme. These laws vary slightly in detail, but generally they do not allow mine-air to contain more than 20 or 25 parts of carbonic acid per 10,000, or less than 20% oxygen. They have been framed on the British laws regulating the quality of air in factories. On the other hand Mr. Reed pointed out that the second report of the Royal Commission on Mines, published in 1909, contains the statement that this low maximum of carbonic acid was not necessary in the case of mines, a judgment that was based on the

expert evidence of Dr. J. S. Haldane and Mr. John Cadman. These experts considered that 125 parts of carbonic acid per 10,000 and not less than 19% of oxygen were permissible figures for mines. Any opinion coming from these two high authorities naturally carries weight. Dr. Haldane is well known as a medical man who has devoted much study to the hygiene of mining, and Mr. Cadman is the professor of mining in Birmingham University. Mr. Reed has therefore good grounds for adopting their views, and for urging that the trouble and expense involved in reducing the carbonic acid content in Australian and Transvaal metal mines are not warranted. However, we disagree with Messrs. Reed, Haldane, and Cadman, for we think that the consideration of this one feature of mine ventilation by itself may lead to erroneous ideas and to biassed conclusions. On referring to the evidence of Messrs. Haldane and Cadman, as published in the report quoted, we find a long physiological argument relating to the injurious effects of carbonic acid on the human frame. It appears that the depth and frequency of breathing are automatically regulated so as to keep the proportion of carbonic acid in the air within the lungs at about 5½%. If there is 1% of carbonic acid in the atmosphere, the depth of breathing is increased by 16%, a difference alleged to be quite inappreciable. If the content increases to 3% the depth of breathing must be doubled. Any exertion in such air is exhausting, and if much labour were habitually done under these conditions the strain on the lungs and heart would be serious. If the carbonic acid content is 6 to 8%, toxic symptoms set in, though 25% is necessary for asphyxiation. As regards deficiency of oxygen, there is no very marked effect if the oxygen falls from 20·9 to 10 or 11%, provided no excess of carbonic acid is present, and it is only when the percentage drops to 7 or 8 that there is any imminent danger of life. On

the other hand, a candle goes out when the oxygen falls to 17½% in the presence of carbonic acid, and will not burn in a satisfactory manner if the oxygen is below 19%. The lights, being so much more sensitive than the men, afford full warning of danger to human life, and the experts therefore considered that no regulations were required as regards carbonic acid and oxygen contents.

This is all very well in theory, but it must be remembered in the first place that most of this discussion was in connection with coal mining, where continuous ventilation is necessary for other reasons, particularly the removal of explosive gases. In a British coal mine the question of maximum content of carbonic acid does not rank equally with the similar question in metal mines abroad. In any case carbonic acid is only one of the obnoxious constituents of the air that have to be considered, and to centre a discussion on that particular gas tends to obscure the general problem. The exception to this complexity of effects is the situation caused at Cobalt and at other localities where air deficient in oxygen is used in the rock-drills, and here the men have not complained of any ill effect, though the candles do not burn brightly. In a metal mine it is not primarily the excess of carbonic acid or the deficiency of oxygen that makes underground atmospheres unpleasant. The trouble arises as a matter of fact from the carbonic oxide and nitrous fumes evolved on blasting, from the dust, and from the heat and dampness of stagnant air at depth. Small amounts of carbonic oxide and nitrous fumes will cause serious trouble to workers, and if the ventilation were regulated so as to allow Mr. Reed's 125 parts per 10,000 of carbonic acid, these other noxious gases would have a cumulative effect on the worker. We therefore urge that though, in the absence of any other deleterious element, the 25 parts of carbonic acid per 10,000 provides a comparatively unnecessary purity of atmosphere, the

regulation fixing this maximum is indirectly of indisputable value. On general principles we may say that adequate ventilation of metal mines is one of the problems connected with the efficiency of labour, itself a subject now properly prominent. In a recent paper Mr. Sydney Penlerick described the highly satisfactory results obtained at small expense in the East Rand Proprietary, and all the new mines and some of the old on the Rand are paying special attention to this matter. Mine-owners are beginning to understand that it is not enough just to keep their men alive; their enlightened self-interest shows them that the more hygienic the conditions the greater will be the efficiency of the labour.

The Bond of Secrecy.

In the course of his excellent inaugural address the new president of the Institution of Mining and Metallurgy, Mr. H. L. Sulman, asked again that professional men should make an effort to interchange their knowledge by publication. The fact that Mr. Sulman himself is a consulting metallurgist suggests a special aspect of this question of the generosity of science and raises a point of professional ethics. A metallurgist, engineer, or chemist may be willing and desirous to contribute freely of his experience to the public discussion of methods and processes, but he may be bound in honour from disclosing details that do not belong solely to himself and from imparting knowledge that he has gained while conducting experimental work for his clients. If he has been engaged as consulting metallurgist to advise upon the value of some new process, to put it into practical shape, or to investigate obvious defects and suggest possible improvements, it is not to be supposed that he would dream for one moment of discussing the matter in public. The clients interested in the process are business men who wish to make money by doing something better than anybody else; they are performing the necessary duty of making a living for them-

selves and are not paying a consulting fee just to enable the metallurgist to benefit the world at large. Similarly, when an engineer is asked to give his opinion on a mine, his report belongs to the company or individual for whom the examination was made. For instance, we do not expect to see Mr. R. J. Frecheville giving a public lecture on Tanganyika Concessions, however much we should value the information he could give. It will thus be seen that it is not only to the professional man that the appeal for reciprocity is to be made; it must be made also to the business men who engage the services of the specialist in the hope of making money thereby.

Those who employ the metallurgist, chemist, or engineer are often far too exacting as regards this question of imparting experience, not only in their dealings with the consulting engineer but also in connection with the permanent staff. A professional man may be asked to agree never to talk about the technological practice both during or subsequently to his connection with the mine or works, and sometimes it is even stipulated that if he leaves the position he must never thereafter engage in similar work elsewhere. There is good and sufficient reason for requiring an employee to keep a still tongue and to maintain a strictly loyal attitude, but to expect a professional man on the severance of his connection to wipe out his stock-in-trade of experience is to ask too much. An engineer who had been in the service of the Rio Tinto company for several years was asked, on resigning to accept a better appointment, to sign a paper binding himself never to write concerning the technical operations, not at all of a secret or confidential character, in which he had been taking a leading part. He refused. We think he was right. The company might impose such a condition before engaging the engineer, and the latter might refuse to accept such a restriction, but once having engaged him without mentioning the subject the company or

its general manager had no right to impose such terms. The most that it could do would be to request the engineer in a friendly way not to write or say anything detrimental to the company's interest, and to such a request no honourable man need demur. Again, to put a hypothetical case: Suppose a copper metallurgist during a three years' engagement worked out an admirable system of applying oil-fuel to reverberatory furnaces, or devised a new method of treating fine concentrate by spraying it into the basic-lined converter, would he at the end of his term be precluded by custom or ethics from reaping the reward of his ability by arranging a similar system of operation at the smelting works of some other company? It seems to us that if the path of the technologist is to be continually barred in this way we shall soon drift back to the dead level of mediocrity, for brilliant men would forsake the profession and turn their attention to, let us say, promoting. However, fortunately for us, the number of ungenerous employers is small; as small as the number of disloyal employees. The question is a difficult one, for it lies on the borderland where business and honour wage continual battle. No code can be formulated to cover all cases, for most decisions will largely depend on the unwritten laws that guide the sort of people that are vulgarly called gentlemen. We submit to our fellow practitioners that a company may do a dishonourable act, but an individual never; that is, the condemnation of an individual is quick and sure, while that of an amorphous coterie of financial administrators is uncertain and ineffective, simply because personal responsibility is lost in collective incapacity. Speaking for the profession we say that a mining engineer or a metallurgist must be loyal long after the company that employed him has broken faith, that he must do his duty long after the directors have escaped theirs, that he must play cricket when the rest of the field has run to cover.

METAL MARKETS

COPPER.

Average prices of cash standard copper :

April 1911	March 1911	April 1910
£54. 3s. 2d.	£54. 16s. 4d.	£57. 5s. 0d.

On the 'standard' market, operators have remained apathetic and have shown themselves indifferent both to the improving statistical position in Europe and to the continued growth of production and of stocks in America. The volume of transactions and range of prices are accordingly again unimportant, while consumption in Europe continues undiminished and buyers have orders in hand to keep them busy for months. Many judges profess to believe that, with gradually improving conditions and a promising outlook in America, the copper market has reached the turning point. The increased American output, however, causes much misgiving, and gives pause to any tendency towards speculative activity. After Easter some spasmodic briskness was caused by buying orders for standard copper believed to emanate from America, but the effect was short-lived owing to the simultaneous reduction of the Amalgamated price to 12½ cents and to £56. 10s. in Europe. While the cut enabled them to sell well for a time the renewed competition of various sellers frightened off consumers again, and on the whole buying for consumption has been more desultory than for some months past. The temporary firmness in standard, however, has brought some good orders from the electrical industries.

TIN.

Average prices of cash tin :

April 1911	March 1911	April 1910
£193. 0s. 10d.	£182. 12s. 4d.	£149. 19s. 3d.

While fluctuations are not so heavy as of late they are as difficult to follow and have had quite as little apparent reason. Cash tin has ranged between £187 and £196. 15s. Bears were impressed by the favourable showing of the March figures and the rush for May and June dates raised prices for these periods rapidly from £188. 10s. to £193 during the two days following their publication ; but the buying ceased as rapidly as it had started, and it only needed another two days to send the cash price down once more to £187. At this point the syndicate gave strong support and again brought up prices to £195 for cash. Since then the alterations in price have been less violent and less rapid, but the variations

are still sufficient to cause great inconvenience to legitimate business. Shipments from the Straits have been very small and when this was realized late in the month shorts became nervous and prices once more moved forward until £196. 15s. was obtainable for cash. From this point Eastern sales of large lines at moderate prices lowered the cash value to £193. 10s. at which level the month closed.

LEAD.

Average prices of soft pig lead :

April 1911	March 1911	April 1910
£12. 18s. 5d.	£13. 2s. 11d.	£12. 13s. 9d.

Prices have been practically unchanged throughout the month. The demand for forward deliveries has been light in accordance with recent experience, but many buyers have been under the necessity of purchasing for prompt delivery, so that stocks held in public store have been largely drawn upon. The effect on prices has however been inappreciable. The syndicate has shown itself an eager seller throughout.

SPELTER.

Average prices of ordinary brands :

April 1911	March 1911	April 1910
£23. 13s. 8d.	£22. 19s. 2d.	£22. 9s. 11d.

Spelter has rapidly advanced in price under the influence of heavy buying by galvanizers. The syndicate has raised its basis, and it is reported that it is very heavily sold for the remainder of the year, and that the quantities still available for sale are unusually limited. While a further advance is not apparently contemplated, it may be expected.

OTHER METALS AND MINERALS.

Prices quoted on May 8 :

SILVER.—24½d. per oz.

PLATINUM.—166s. per oz.

BISMUTH.—7s. 6d. per lb.

ALUMINIUM.—£67 per ton.

NICKEL.—£169 per ton.

COBALT.—9s. 9d. per lb.

ANTIMONY.—£33 per ton.

QUICKSILVER.—£9 per flask of 75 lb.

MANGANESE ORE.—8d. to 9½d. per unit (1%).

IRON ORE.—Cumberland hematite 20s. per ton at mine. Spanish 21s. 9d. delivered in England.

PIG IRON.—Cleveland 46s. 6d. per ton. Hematite 62s. per ton.

WOLFRAM ORE—35s. 6d. per unit (1%).

SPECIAL CORRESPONDENCE

News from our own Correspondents at the principal mining centres

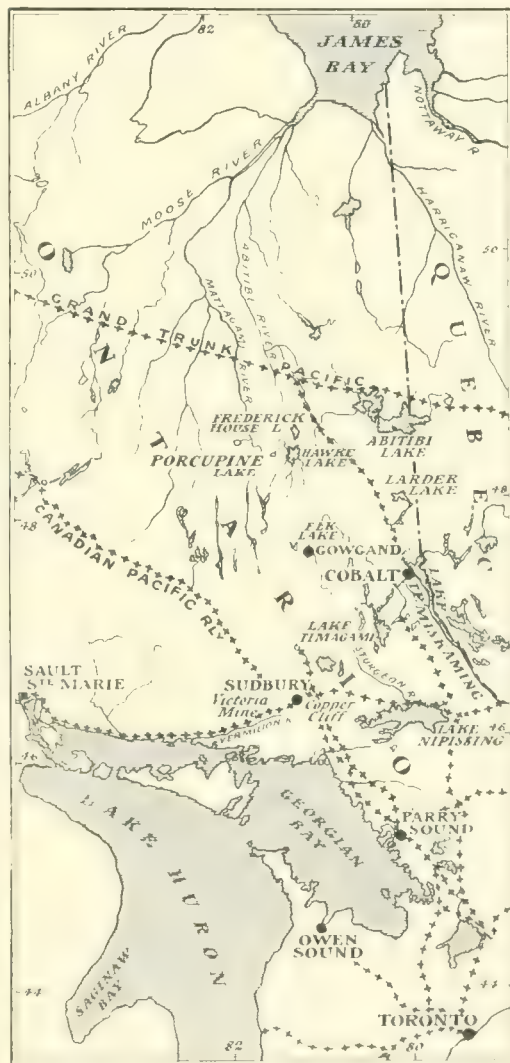
TORONTO.

The Porcupine boom had a serious setback this week, all the issues declining, some of them to a figure lower than that at which the stock was underwritten. This is said to be due to large blocks having been thrown on the market by buyers who, being disappointed in the expectation of an immediate rise in prices, were unable to meet their obligations. The market has recovered within the last day or two, so far as the leading issues are concerned. The incident does not tend to encourage the expectation that there is likely to be a marked and steady advance in Porcupines in the near future. There have been so many flotations latterly that the market is glutted, and frequent recessions tend to make buyers cautious.

The break-up of the winter has put an end to heavy road traffic into the Porcupine camp, so that the mines that have not already got their plants will have to wait the opening of the railway, which is anticipated in about three months. Excellent progress is being made in the work of construction. At the camp itself development work is being actively pushed. A close estimate puts the number of men now at work at 1200, which will be largely increased with the advance of spring. Twelve compressor plants are either installed or on the ground and 52 air-drills and 2 steam-drills will be operated.

Some changes have been made in the plans of the Hollinger. The 30-stamp mill is to be supplemented by three tube-mills for the treatment of concentrate by the cyanide process. This will considerably increase the crushing capacity of the stamps, as the ore will not require to be crushed so fine. A diamond-drill is being installed to test the orebody in depth. Driving has been extended for 60 ft. on the 200-ft. level, the lode being 10 ft. wide and rich in free gold. On the 100-ft. level the two shafts are now connected, and a total of 1400 ft. of driving has been done. A cross-cut on this level has intersected a quartz vein previously traced on the surface. The Ontario Porcupine Gold Fields Development Co. has been organized as a subsidiary concern by the Northern Ontario Exploration Co., to operate the 50 claims lately acquired by the latter. The capitalization is placed at \$3,000,000,

of which the working capital will be about \$500,000. Bewick, Moreing & Co. will be the general managers, with a Canadian advisory committee consisting of Noah Timmins,



Northern Ontario. Showing the new mining districts.

Henry Timmins, and John McMartin. The Foley-O'Brian mine has been taken over by the Foley-O'Brian Mines, Ltd. A large body of ore has been blocked out in the No. 1 shaft, which is down 68 ft., some of the ore assaying

work. The No. 1 shaft is down 130 ft. The Callinan location, adjoining the West Dome, has been sold to an American syndicate for \$225,000. At the Vipond a 2-drill compressor is being installed. One shaft is down 100 ft. with a cross-cut of 46 ft. to the vein. High-grade ore is being taken out. The two Shillington-Richardson claims, just north of the Armstrong-McGibbon holdings at the east end of Pearl lake, have been taken over by the Porcupine Gold Trust for \$150,000, and a force of men put to work. At the Standard, lying south of the Callinan claims, two shafts are down over 40 ft. and a good find has been made in one of them. A rich vein has been struck on the 50 ft. level of the Crown Chartered; this is 3 ft. wide of sulphide ore running \$32 per ton and is believed to be a continuation of the Vipond vein. In diamond-drilling on the Dobie Mines Co.'s property free gold has been struck at a depth of 240 ft. The Burns-Goad claims, three in number, in the southeastern part of Shaw township, have been sold to a Chicago syndicate for \$100,000.

Cobalt continues to suffer from a shortage of power, so that shipments have fallen off. The output for March was only 1819 tons of ore, as compared with 2516 tons in March 1910. The Nipissing and La Rose declared their regular quarterly dividends last month of $7\frac{1}{2}$ and 2% respectively. The directors of the La Rose continue to adhere to their policy of accumulating a large cash surplus before increasing dividends. The treasurer's report showed \$1,079,000 on hand. Kerr Lake has declared a 10% dividend for the quarter, which makes the total amount returned to shareholders \$3,030,000, being 1% in excess of its capital. Crown Reserve is also doing well, having a surplus of \$698,000 after paying its monthly 5% dividend, and the government royalty. The Temiskaming has paid a 3% dividend and has a surplus of \$377,165. Good ore is being taken from the winze at the 575 ft. level, which is by far the deepest working in the camp. The Beaver has declared its initial dividend of $2\frac{1}{2}$ %. It is announced as merely an interim dividend. The mine has good ore on the 200, 250, and 300 ft. levels, the new vein known as No. 3 being 8 in. wide on the 300-ft. level and assaying 2900 oz. per ton. The Right of Way, as was anticipated, has passed its dividend. The reason assigned by the management is want of power, but it is generally believed that the real reason is lack of ore. The Nova Scotia statement for the year ending October 31 shows a deficit of \$235,064. Later operations have been more

profitable, the profits on bullion shipped up to March 1 being about \$38,000. The Erie Cobalt, with liabilities of \$33,000, is in liquidation. The Wettlaufer property in South Lorrain has been taken over by the Mines Finance Co. of America.

Diamonds.—The news of diamonds having been found in the Tulameen district of British Columbia has aroused considerable interest, and the Geological Survey has received numerous inquiries from prospectors, some of whom have started for the district. Charles Camsell, of the Survey will return there this season to make further investigations. R. A. A. Johnston, mineralogist of the Survey, considers it likely that diamond-bearing rocks may be found in the Porcupine district.

Railways.—It is understood that the Ontario Government has decided not to undertake the construction of a branch of the Temiskaming & Northern Ontario Railway to Gowganda, but is willing to grant a charter to any private company for the purpose. This railway system will probably be extended in other and probably more profitable directions, for both Gowganda and Elk Lake have so far failed to make good. The T. & N. O. Commission has just arranged for the purchase, for \$250,000, of the Nipissing Central Railway, an electric line connecting Cobalt with Haileybury, the charter of which covers a route to New Liskeard and round the north end of Lake Nipissing to the Quebec border. The purchase, which includes control of the water power at High Falls, is regarded as a practical step toward the electrification of the entire system, which the Commission has had in contemplation for some time. The development of power for railway operations would also relieve the situation at Cobalt, as a surplus could be generated to supply the mines.

JOHANNESBURG.

Ore-Reserve Estimation.—The Geduld Proprietary has been faced by a difficult problem in the publication of an ore-reserve estimate. The solution found is, I fear, a faulty one. The situation is as follows: In this flat mine, the scheme of development involves the placing of winzes and rises at greater distances apart than is common practice in other Rand mines. Consequently the ore stands in big blocks, so big that the consulting engineer is rightly nervous about committing himself to a declaration of the value of the full tonnage exposed, based on the common perimeter valuation. A way out of the difficulty is attempted by declaring the tonnage (444,600)

and then a "lineal assay-value of 9'09 dwt. over a milling width of 37'3 in." A further quantity of probable ore (102,300 tons) is said to be "indicated by 2785 feet of development work on reef, the average lineal assay-value of which is 10'68 dwt. over 41 in." The Chairman (Mr. M. G. Elkan) gives a lengthy explanation of the method adopted—or an apology for it. He says that under the circumstances mentioned "no engineer would take the responsibility on himself of estimating the value of the ore contents on the basis of the assay results obtained in the drives, rises, and winzes surrounding (these large blocks), which represent a small footage in comparison to the quantity of ore contained in such blocks." He then proceeds to make



Figure 1. Randfontein 'small mine'

the peculiar assertion that the subdivision of ground into smaller areas, in order "to ascertain the value of the ore with any degree of accuracy," would serve practically no other purpose than to "satisfy curiosity." It is fortunate indeed that such an appalling lack of understanding of the legitimate needs of European shareholders for reliable information did not appear in an Eckstein or a Gold Fields' board room, though such an idea is scarcely thinkable. Is "curiosity" the term also to apply to the shareholders' anxiety to know what relation this "average lineal assay-value" bears to the probable value of the tonnage; what relation there has been between the yield of 6'5 dwt. from the 127,510 tons milled during 1910 and its original "lineal-assay-value"; what discrepancy there is between current results and the 'lineal' value estimated at December 31, 1910; and whether this ascertainable discrepancy has been applied as a discounting factor to other assay-values. It is useless to publish this figure of

9'09 dwt. over 37'3 in. and then to disclaim responsibility for its application to the tonnage declared. What other figure is provided as a guide to future results? What shareholder can be expected to understand the difference between this average for footage and the usual average for tonnage?

Mine Ventilation.—The review of what has been decided upon or actually been done in the principal Eckstein mines in the matter of mechanical ventilation, given by Mr. Schumacher in his Rand Mines speech, was particularly interesting. At the present rate of progress, the Witwatersrand will soon become the best ventilated metalliferous district in the world. Summarizing the facts regarding Eckstein mines alone, we find the position as follows:

Rose Deep. On order: 1 Rateau fan, 80,000 cu. ft. per min.; 1 Sirocco, 25,000 cu. ft. per minute.

Nourse Mines. On order: 1 Rateau, 75,000 cu. ft. per min.; 1 Sirocco, 100,000 cu. ft. per minute.

Ferreira Deep. Two small fans on order, each of about 30,000 cu. ft. per min. capacity.

Crown Mines. Erected: 1 Sirocco, 250,000 cu. ft. per minute.

Durban Deep. On order: 1 Sirocco, 50,000 cu. ft. per minute.

City Deep. Two fans with combined capacity of 250,000 cu. ft. per min. to be installed.

Village Deep. In use for over a year: 1 Sirocco, 270,000 cu. ft. per minute.

Shaking Amalgamating Plates.—Ever since tube-mills were introduced on the Rand, it has been held essential that the pulp should be passed over shaking plates for efficient amalgamation, owing to the thickness of the pulp. The facts now presented by W. R. Dowling before the Chemical, Metallurgical & Mining Society seem to indicate that there has been excessive conservatism and a blind following of precedent in the matter. Instead of four shaking plates (10½ by 4¾ ft.) to each tube-mill, long employed at the Knight's Deep, the ratio has been reduced to two stationary plates to each tube without reduced recovery. There is no banking of sand. With a fall of 18%, the minimum percentage of water in the pulp is 55%. This new arrangement, together with the elimination of the stamp-mill plates, results in efficiency being attained with a wonderfully low plate-area per stamp-unit. Mr. Dowling states that at the Randfontein Central, the total plates erected are equivalent to 9'6 sq.

ft. per stamp-unit but that this will be reduced to 4'8 sq. ft. In the Simmer & Jack re-arrangement, the plate-area is only 2 sq. ft. per stamp-unit. In this plant there are now only 18 stationary plates instead of the former 64 battery-plates and 30 shaking tube-mill plates.

Roodepoort United.—It is one of those anomalies not uncommon on the Rand that the fine new plant of the Roodepoort United—in many respects a model for compactness and economy—should be destined to treat such poor 'stuff' as the old Kimberley Roodepoort can produce. A yield of only 21s. or 22s. is declared, in spite of high sorting, and a yield of 24s. estimated. This mine has been recording stamp-duties of 23 tons per 24 hours. The mill, of which only a part is in operation, comprises 100 stamps, with a falling weight of 1900 lb. The cam-shafts are of nickel-steel. Pile-blocks are of reinforced concrete in accordance with the universal local practice today, and the timber king-posts stand on cast-iron stools. All the reduction plant is operated by electric power supplied by the Transvaal Power Co. at 10,000 volts. Each battery of 10 stamps has a separate line-shaft driven by a 50 hp. motor. There are five tube-mills, each delivering to seven shaking tables in the plate-house. In February, the milling charge was 1s. 6d. per ton and the cyaniding costs 1s. 5d., which are satisfactory figures for the comparatively small tonnage (28,000 tons) treated.

The European Shareholder.—Mr. Elkan, in his speech, expressed kindly sympathy for the poor ignorant European shareholder, who might be unable to understand the new system of ore-reserve declaration, which lacks "any degree of accuracy." He said: "I know that the method of giving the results of the development work in lineal assay-values has caused some confusion in the minds of shareholders, who are perhaps not so conversant with mining conditions and mining terms generally as you are." This, to a body of enlightened South Africans. Most unfortunately for Mr. Elkan, the meeting of the Government Gold Mining Area (Modderfontein) Consolidated, Ltd., was held on the following day, when Mr. John Munro, one of the pioneer Barnato directors, stated, in referring to the Geduld as a neighbouring mine: "The ore reserves at the end of the year showed an average assay-value of 9'09 dwt. over 37'3 inches." That was all, but surely enough to satisfy the chairman of the Geduld that if he wishes his Board to retain confidence as a re-

sponsible control, able to represent the ore-reserve position in a fairly rational manner (however conservatively), an improvement must be made upon present systems and he must not resort to an ambiguous statement, which 99% of the shareholders are liable to misconstrue without discredit to their intelligence. The Modderfontein B Company has been faced with rather similar difficulties, owing to the large size of blocks, but it nevertheless publishes a statement of ore-reserve, at a value (7 dwt. over 48 in.) representing the application of lineal assay-averages to blocks by those possessed of all available evidence and qualified by this special knowledge to form the best possible estimate of the value of the ore developed. The statement is accompanied by an explanation of the difficulties of precise valuation, which means that a careful investor would slightly increase his discounting factor as a protection. But the Geduld simply hands out a string of assays and tells shareholders they can do what they like with it. To put the matter bluntly, the information provided to shareholders at the meeting was worse than nothing.

Straight Driving.—The policy of driving from point to point under the reef in the Rand Collieries was criticized in these columns a year ago, and the experience of the past year has presented no results to place the scheme in a more favourable light. With its neighbour, the Van Dyk, closed down, the Rand Collieries cannot gain too much information for trustworthy reef valuation, even though it may be paid for later by possibly less efficient tramming. Mr. George Albu was obliged to acknowledge at the last meeting that "the sampling at such comparatively long intervals as 40 feet (in cross-cuts from foot-wall drifts) where the reef conditions are as yet very imperfectly known cannot be regarded with any degree of reliability."

Small Stope-Drills.—The fact that, according to Mr. S. Evans, 23½% of the fathomage stoped in the Crown Deep ground of the Crown Mines is being broken by small machines, is more encouraging than the findings of any competitive test; yet it would be dangerous to declare that the recent trial has not materially influenced the development of small drilling practice. It is unfortunate that Mr. Evans did not also mention the make of drills used. Broadly speaking the Siskol, Chersen, and Holman stope-drills are those that promise to hold the field for some time. The improved efficiency of this type of machine is important, for though labour has been more

plentiful, the quality supplied has left much to be desired. Too many Kaffir *umfaans* (lads) and *picannins*—mere children—pass muster for underground work. The evils of open recruiting are being widely experienced. The principal trouble lies on the Rand. Agents, spurred by the big gains for successful operations, have their 'boys' in many compounds, bribing or luring natives who are actually or nearly time-expired to change over to other mines, instead of re-engaging where they have been trained to their work. This serious competition among the mines for the services of Kaffirs will be one of the factors tending to check the reduction of mining costs on the Rand.



Part of the Bond.

Randfontein's White Elephant.—In letters despatched during the past year, I have made numerous references to the 600-stamp-mill of the Randfontein Central and expressed pessimistic opinions as to the preparedness of the mine for this huge stamping capacity. The view has, indeed, been frequently expressed that the policy of the company has been foolhardy and ill-considered. The unforeseen often upsets the most deliberate predictions and it has been an unexpected change of administration—a personal 'variable' difficult to determine—that now pro-

mises to shatter all pessimistic prophecies. Randfontein Central has a 600-stamp mill. The great difficulty will be to feed it from present development on narrow 'reefs.' Great mining problems have thus been solved and the highest efficiency attained in underground departments. J. W. H. Stubbs, virtually consulting engineer, is leaving. So far, the conditions are clear, but, now, rudely upsetting all calculations, Sir J. B. Robinson has taken up his residence at Randfontein, where he will control operations. Of course, this changes the whole complexion of things. Yet how could such a contingency be foreseen? On what grounds could one have dared to anticipate that the technical problems of Randfontein would be accorded the benefits of such expert engineering skill?

SAN FRANCISCO.

Quicksilver is attracting more attention on the Coast. The increase in cyanidation cut into the market so heavily, and the grade of the ore decreased so rapidly, that some years since California producers found themselves in a close place. With less demand, higher costs, and threatened competition from abroad, they combined with foreign producers and marketed their metal through a single agency. The result was a featureless market. Last year there was a temporary shortage and prices rose. Promptly the search for new mines began and with it an investigation of the marketing methods. Charges of unfairness were made; it is even said that the famous shipment of an accumulated American 'surplus' to China from San Francisco was re-imported at New York and distributed to American buyers at an advance which afforded a profit on the whole deal. However that may be, the old arrangement has gone by the board and the producers are now marketing through independent agents. So far prices have not been affected but what may result when the Nevada mines begin to produce is uncertain. Strong interests are known to be ready to buy and hold quicksilver at present prices, if necessary to support the market, and the future will be watched with interest.

The Mother Lode, the scene of the first quartz mining in California, still produces approximately one-third of the output of the State. This is now equalled by the output from the dredges, while over half of the remaining third comes from Nevada county and the Randsburg district. The four counties through which the Mother Lode extends had

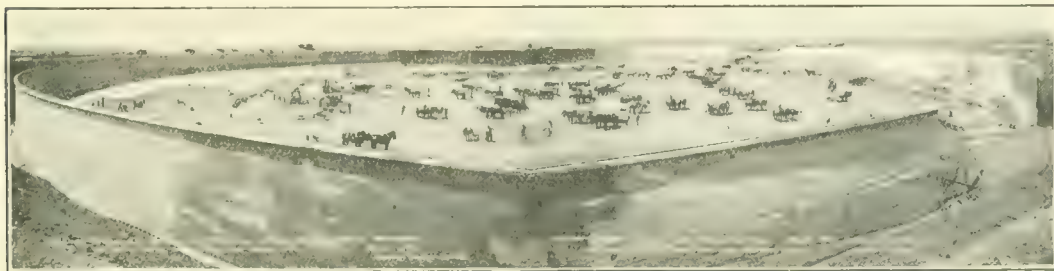
the following production in 1909, the last year for which complete figures are available: Anaconda, \$1,108,800; Calaveras, \$1,410,411; Mariposa, \$396,465; Tuolumne, \$925,703. The district is one of perennial interest because of the simplicity of the ore, the persistence of the veins, and the depth of the mines. The Kennedy mine at Jackson, operating through a vertical shaft 3550 ft. deep, has the record for depth so far as American gold mines are concerned. The district extends nearly 70 miles in a northwest course along the western foothill region of the Sierra Nevada. The belt is three to six miles wide and along the whole course there are quartz outcrops marking a notable series of linked veins. The country-rock consists of black slate, schist, greenstone, the highly metamorphosed representatives of Paleozoic and Jura-Trias sediments and volcanics. The veins occur along a line of structural weakness where there has been repeated movement with resulting formation of openings and recementation by quartz. The ore is essentially white quartz containing gold free and in iron pyrite. Minor amounts of other sulphides and of tellurides occur. It is not essentially different at the lowest known depths from that mined within a few hundred feet of the surface and this affords strong presumptive evidence of its primary origin. The grade is low; exact figures are hard to obtain since the companies operating are largely close corporations. The ore actually mined in quantity assays from \$3 to \$5 per ton. Much richer ore is found in individual stopes. Power costs are unusually low; as little as \$1.50 per horse-power per month where water is used directly, and \$4.10 where electricity is bought. Living costing relatively little, wages are also low. Despite therefore the high cost for timbering, as much as \$1 per ton in instances, it is possible to work low-grade ores. Costs are hard to compare because of differences in methods of accounting, but where allowance for depreciation and taxes is made they range from \$2.60 to \$3.50 per ton. Operating expenses taken alone amount to as little as \$1.08 at one property. The stopes are wide, 20 to 30 ft. being not unusual and 80-ft. stopes being occasionally worked. At the south end of the lode the ground is worked by shrinkage stoping. Farther north it is necessary to square-set and fill. Hoisting is done by skips and the mills quite uniformly include simply stamps, amalgamating plates, and vanners. Formerly the concentrate, which assays \$35 to \$70 per ton, was treated locally in small chlorination plants. Except those at the Eagle-

Shawmut and Kennedy, these plants have been closed and the concentrate is now shipped, at a cost of \$6.50 to \$8 per ton, to smelters for treatment. Cyanidation has never been introduced though proved feasible at the Melones mine. Experiments are being now conducted at one or two properties and a change is to be expected. It must be admitted that in certain particulars the operators in this district have fallen into a rut, but in extenuation it is proper to say that there have been many disastrous experiments with new methods, that the margin of profit is small at best, and that the everyday difficulties are sufficiently numerous to tax the ingenuity of any manager. In general the mines are owned by Californians, though there has been some disposition recently for outside capital, particularly that from France, to enter the district. The new investors have not been altogether fortunate. That there is opportunity for investment and for improvement in methods is fairly certain, but the district is one where gold mining must be conducted as a business rather than a speculation. The scale of operations must be large, for the profit per ton is small.

Tonopah geology has given rise to much discussion. The small but unusually rich lodes, from which millions of dollars worth of ore have been taken, occur in a complex and much faulted mass of young volcanic rocks. That ore was formed here in quantities comparable to those in other great gold-silver districts has been certain for some years. Repeated faulting and intrusion of later rocks has so broken and scattered the orebodies that the cost of finding and mining them has been unusually high. At one time it was thought that it would be impracticable to develop more than one or two mines in the district but later work has been much more encouraging. Under these conditions the voice of the geologist has been heard with unusual respect. In the early days of Tonopah J. E. Spurr, at that time an officer of the United States Geological Survey, studied the district. He condemned much of the outlying territory and was correspondingly unpopular with those who were capitalizing hopes and dressing wild-cats for the market. His work, however, in distinguishing the various volcanic rocks and interpreting the faulting proved extremely valuable. The main lodes are found in an 'earlier andesite' much broken by faulting and separated into blocks by later intrusions. Other lodes have been found, but those in the 'earlier andesite' are still the main-stay of the district. As development progressed question

arose as to the intrusive character of many of the rocks and after much study J. A. Burgess, geologist for the Tonopah Mining Co., announced his belief that the whole complex was made up of a series of successive surface flows laid down in normal order. The significance of this view in relation to the persistence of the ore is evident. Last year Mr. Spurr, now in private practice, was invited by the principal companies at Tonopah to re-study the district. His report has just been made public. It is exceedingly technical but in general he holds to essentially the same views that he first expressed. The 'earlier andesite' is found to be a trachyte, but it is still held to be the oldest rock in the district and the locus of the main lodes. While one of the other formations is in part extrusive, the series is essentially made up of intrusive sheets in reverse order, the youngest at the bottom. Operators at Tonopah therefore must continue to hunt for ore laterally rather than in depth and

out to the amount of \$12,746,000. Of the 400,000 shares, 240,000 are owned by the Southern Pacific and 60,000 by officials of that company or allied interests. The company has large land holdings, wells, pipe-lines, and ships, and has been particularly successful in the marketing end of its business. It has been relatively less successful in finding oil, though it has a large production. Last year it was compelled to contract with the Independent Producers Agency to secure oil to fill its contracts and this year it is reported to have been unable to furnish oil needed by the Southern Pacific. The Associated has paid few dividends, the bulk of the profits having gone into development, but even at that the company has not received money as fast as required. It is none the less a splendid property and the buyers, whoever they may be, are to be congratulated. That the Southern Pacific is willing to let go is believed to be due to the newly adopted policy



CONCRETE RESERVOIR TO HOLD 10,000 BBL. OF OIL NEAR SAN LUIS OBISPO, CALIFORNIA.

each orebody may be expected to be bounded by fault-planes or intrusive contacts. Fortunately the game is worth the candle and the operators and engineers have proved their ability to handle the situation.

Petroleum-producers in California have had their fill of exciting rumours of deals this last month. Several big sales have taken place; that others are in prospect is certain, but these seem to hang fire. The most startling announcement was that the Rothschilds were to buy the Associated Oil Co., and on the strength of the announcement made by several papers the price of the stock rose rapidly. As the days passed without official confirmation of the reputed sale, prices have sagged a bit but still are sufficiently high to indicate a wide belief that such a sale is really in prospect. The Associated Oil Co. is one of the three big corporations operating in California, ranking with the Standard and the Union. It is capitalized at \$40,000,000 and has bonds

of confining the business of that company to transportation, a policy now demanded by public opinion and congressional enactment. The second rumoured deal was the sale of the Union Oil Co. to the Standard. This has been authoritatively denied. It is known, however, that the properties of the Union have recently been thoroughly examined and valued by independent engineers, but whether for the company itself or outsiders is not known. The Union is an extremely valuable property built up entirely by independents. It early obtained control over the districts in which the lighter grades of oil occur and so has dominated the local refining business. Later it became an important factor in the fuel oil business and in the allied interests. That a new group of producers of first rank is being formed is indicated by the announcement that W. P. Hammon, acting for British investors, has purchased the Empire, Lucile, De Luxe, Zier, and Republic

holdings, to which have been joined the Valencitos. It is said that no securities are to be placed on the market, the whole of the funds having come from experienced oil-men, supposedly the Shell interests. Ralph Arnold is geologist and engineer for the new corporation and selected the properties that have been purchased.

Amid all these changes routine work proceeds much as usual. Dividends to the amount of \$1,838,534 have been paid in the last three months. Production for March is estimated at 6,341,603 bbl., an increase of 12,000 bbl. per day over that for February. The Independent Producers Agency has held a harmonious meeting, re-electing L. P. St. Clair president, and S. W. Morshead vice-president. A plan for financing the purchase and storage of oil for three years was discussed, but no conclusion reached. The Standard Oil Co. has recently transferred F. H. Hillman to California. He made an enviable record as general manager for that corporation in Illinois, where he provided pipe-lines and storage facilities for handling over 30,000,000 bbl. per year, all within three years of the first discovery and with a minimum of friction. He secured for the Standard a dominant position in that great field, and retained the goodwill of the independents. That he has been placed in charge in California is interpreted to mean that the Standard is dissatisfied at having here a much smaller share of the business than it usually obtains.

Fuel problems on the Pacific Coast are not concerned alone with California petroleum. The Northwest has never depended much on the oil-fields, and, aside from taking oil that would otherwise depress the local market, has yielded small profit to California producers. Announcement therefore that a shipment of petroleum has been made from Katalla (Alaska) to Seattle (Washington) is not regarded as of much immediate importance. The Katalla fields lie near the coast and are connected with the shipping point by a 2-inch pipe-line. A 4-in. line is about to be laid and the production of the wells now down is reported at 1200 bbl. A considerable area has been reported as probably petroliferous by the Geological Survey and active drilling is expected this year. The claims were located some years ago and hence are free from complications regarding patents, though development has been retarded by litigation between companies and individuals interested in the enterprise. British Columbia coal, as a matter of fact, supplies most of the Northwest fuel trade and comes as far south

as San Francisco in quantity. Indeed the Western Fuel Co. of San Francisco owns several of the most important collieries at Nanaimo. Until recently they also leased the Dunsmuir properties. These have now been sold to Mackenzie, Mann & Co., Ltd., and several new collieries are to be opened. The Pacific Coast Co., Ltd., also has improvements under way and altogether the coal trade, while not growing rapidly, is far from being a dead industry. One effect of the introduction of oil as fuel has been to require more careful preparation of coal for the market. Formerly washed coal still containing as much as 24% ash was sold. Now a cleaner product is demanded and plants similar to those used in Middle West are being designed for the district by the Roberts & Schaefer Co. of Chicago.

VANCOUVER.

Labour Troubles.—British Columbia is again in the throes of labour unrest, which threatens a shut-down of the principal mines and smelters. With the beginning of April the agreements between the coal operators in the Crows Nest Pass and the men terminated. Meetings of both sides had previously been held to formulate terms for its renewal, but the operators refused to accept the demands of the men on certain points, and immediately the contract term expired, the men, to the number of 7000, ceased work, contending that they had not struck, and so did not come under the Lemieux Act for the arbitration of labour disputes. The Dominion Government, however, refused to accept that position, and gave both sides notice that unless they would avail themselves of the Act, a Royal Commission would be appointed with plenary powers, and a full investigation would be insisted on. The operators then met and advised the Government that they would accept arbitration, but the men have not yet replied, and if they do not accept the overtures of the Government the Department of Labour will act independently. On work being suspended, James Ashworth, general manager of the Crows Nest Pass Coal Co.'s mines, tendered his resignation, and will return to England.

Sheep Creek is attracting a good deal of attention as a gold district. Vancouver capitalists have just underwritten the balance of the treasury stock of the Nugget mine, and the additional capital will be used to install a 20-stamp mill in lieu of the 4-stamp mill now on the ground. C. F. Law is in London in connection with a deal by British South African capitalists for the Queen mine.

Graham Island.—Several companies are being floated to exploit the coal lands on Graham Island. As no development has yet been done in that part of the Province the value of the field is an unknown quantity. It is likely that the coming summer will see a good deal of drilling and exploratory work. The west coast of the island is to be investigated for oil, of which there are surface indications, and the first drilling plant has been sent up to test the ground.

Lillooet.—Renewed interest is being shown in Lillooet, which is one of our oldest vein-mining districts, several arastras having been successfully operated there in former years. The distance from a railway and the cost of transport are the principal reasons why the district has been neglected. The run of the Lorne Amalgamated Mill last fall, averaging rather better than \$14 per ton, is responsible for the new interest. The Ben d'Or has been taken up by Victoria capitalists, who have despatched a force to do development work, and other properties are under negotiation.

Wild Cats.—Desperate efforts are being made to organize a boom for Steamboat mountain, on the Skagit river, near the international boundary. So far there is nothing to justify such, as the discovery of gold-bearing ores associated with dacite and andesite flows was made too late last season to admit of development. Already the 'wild cats' are in evidence. One prospectus, for instance, asserts its claims to be located on a "vein 30 miles long and 15 miles wide," while the plan accompanying it is of another property and the reports of the sampling given are not taken from the location, which has until now been covered with 15 ft. of snow. There are favourable indications at Steamboat, but that is the most that can yet be said of it, and while the newspapers tell of a million dollars worth of ore in sight and fabulous values, all mining men who know anything of the camp say that the ore is likely to be of low grade.

The Hedley Gold Mining Co., operating the Nickel Plate mine in Similkameen, has just paid a quarterly dividend at the rate of 12% and an extra dividend at the rate of 8% on its capital stock of \$1,200,000. The annual report shows the profits for the year to have been \$263,986. The mill has been remodelled and is treating 145 tons daily. The Platinum Goldfields, Ltd., has conducted a systematic testing of the gravels of the Tulameen river in the Similkameen district by means of churn-drills during the winter, the ice on the river

greatly facilitating the work. As a result it is proposed to place a dredge on that stream. The returns show the platinum contents of the gravel to amount to 10% of the gold. The discovery of diamonds in situ in British Columbia is also worthy of note. The discovery was made by Charles Camsell of the Geological Survey. The locality is the Tulameen, and the matrix of the diamonds is dunite. The discovery, however, is of scientific rather than economic interest as the 'stones' are only of microscopic size, though there is the possibility that larger diamonds may yet be found.

The Ikeda Mines Ltd. has been formed to take over a mine on Queen Charlotte Island that was discovered and developed to its present stage by Japanese. Before offering this property to the public the promoters obtained the assurance of competent engineers that sufficient ore was available. There appears to be a wide-spread determination throughout the Province to suppress wild-catting in all its forms and place the industry on a clean business basis.

MELBOURNE.

The State Mine experiment in Victoria is progressing in a way that gives officialdom great satisfaction. The first balance-sheet showed a dead loss, but now the Department, ignoring the pledge given to the Legislative Council when it assented to the scheme, is competing with the privately owned mines. These it hits hardest over the sale of slack. As the coal at the Powlett Basin is friable, a large quantity of slack is produced. This is sold at prices with which the other pits cannot compete. The result is that they are discharging hands, and as there is no vacancy for men on the State Coal staff, distress is occasioned apart from the loss of capital involved. This is the cruellest part of the business. The State partly wet-nursed the other Gippsland mines by conceding special railway freights; now it sneaks off with their customers by under-cutting the price of coal on the market. As the State does not take a profit on its enterprise it can do so. The early career of this mine is much like that of others in Gippsland. At the surface they all did well. As depth increases and faults had to be faced, working costs advanced, the result being that calls had to be made. It may be conceded that the users of slack coal and the railway department are getting fairly cheap fuel under the present arrangement, though not so cheap as many people imagine, because the coal is

inferior to that from Newcastle. As the State is paying low wages, the mining community throughout Victoria is dissatisfied. It wants to be put on the same footing, wants model houses, new streets, and low rents. The man who has not only to earn interest on his capital and provide for its replacement through the exhaustion of a wasting asset cannot afford to raise the wages of his employees. Call-payers view the position with affright, and are withdrawing capital from gold mining. The Chamber of Mines attacks the socialism of the Government, but in vain. We have to run the course of the disease until hard times bring to all a sense of the wisdom of relying on private enterprise as the main prop of national prosperity.

Gold Dredging.—There has been a difference of opinion between Mr. McBride, the Victoria Minister of Mines, and some of the leading Bright gold dredge-masters over the re-soiling trouble. Mr. McBride and the Departmental Sludge Board insist that all the ground treated by bucket dredges and carrying 2 ft. or more of loam should first be stripped so as to allow the loam to be re-deposited on the top of gravel previously excavated by the dredges. Any novice can realize that when working a big dredge it is next to impossible to save only two feet of loam. Mr. McBride, having more pride of office than practical knowledge, says this is all fudge. He was at once met by the offer that if his officers could prove how his ideas were to be applied, they could have the use of a dredge free of cost and the services of the staff. Such a working demonstration would have settled the dispute in a week. But Mr. McBride is not built that way. He says "Do it," and then forfeits the lease of the man who insists on the impossibility of complying with the official mandate. The result of the harsh reading of the departmental lease-covenants is that capital sunk in dredging in Victoria is being rapidly withdrawn. One leading man is off to New Caledonia; New South Wales investors are returning to their own country; diplomats make a pretence of meeting the wishes of the Minister; but the industry suffers.

Mount Lyell.—Signs are not wanting that the Mount Lyell miners intend to make the most of the decision given by the Arbitration Court in favour of an increase in wages to various classes of workmen. They want the company now to grant them an all-round advance. It is hard to see how the position is to be handled. At Cobar the wage-earners are making matters unpleasant for the mine-owners. The

general rule there has been that wages shall be a shilling per shift less than at Broken Hill, but the miners now demand an equality, and in the meantime men are leaving the place for other centres where wage-boards have made conditions more pleasant. The Mount Lyell company cannot afford to see a similar draining of workers from its mine. The reasons that weighed with the directors of the Broken Hill companies to treat with their employees do not exist at Mount Lyell. The price of copper is so low that the company recently had to abandon its bonus dividend and the shares now yield only a small return. It is true, the superphosphate industry is a second string, but that cannot give a return sufficient to cover the cost of any substantial increase in wages to the men. As the ore averages only 2.2% copper there is not much margin for profits and increase in wages at the present price of the metal. The company is however in a position to stand a fairly prolonged siege should hostilities be begun in earnest by the miners.

In Queensland mining operations continue to prove the mineral wealth of that country. Unfortunately in the case of the Mount Cuthbert copper mine, which is farthest north, a stupid dispute that ought to be settled in ten minutes threatens litigation. The trouble is over a sale of reserve shares to the Baillieu group. Development work at the mine has established the value of the property. What is wanted now is the co-operation of the proprietors, so that some well organized scheme of finance should be evolved and the mine brought into reach of the railway system. A personal lawsuit has to be settled, and until then the outlook for a progressive policy is doubtful. At the Great Fitzroy no one really knows how matters are progressing. On the one side of the street it is rumoured that D. P. Mitchell is satisfied with the recovery achieved by the flotation plant, and on the other side there is nothing but the deepest pessimism. The fact is that the company has wanted a good deal more cash than has been available. This is most regrettable, for after all the Great Fitzroy treatment plant will practically determine what is to happen to the mine. Results will also have an important bearing on the adoption of the flotation process for low-grade copper deposits. A much more cheerful tale can be told of the Hampden. There the reserve of ore has increased so satisfactorily that the directors have decided to increase the smelting plant. The way in which shares have come hither from British holders indi-

cates the good opinion of Victorian investors. At present over £1,000,000 worth of copper ore is proved in the Hampden and the Duchess, so there is something to start upon. Of great importance to the Hampden is the work being done to the south by the Consols. On this property rich ore has been proved right up to the Hampden boundary, and if the Hampden gets the continuation of the shoot at the shaft, 400 ft. distant, the value of the mine will be vastly enhanced. Little is heard of the Consols as it is largely in the hands of William Orr, an old Broken Hill man who has retained a firm hold on the property.

Tin Mining.—Southern Australia, and for the matter of that Western Australia, needs a new mining district—copper, gold, silver, or tin. The price of tin is inducing some Mel-

disappeared. Some of the miners wanted to veto the recently signed agreement on the ground that the length of time covered by the contract ($4\frac{1}{2}$ years) was too great, but the majority of the men declined to follow such a lead. In this they showed their wisdom. Should there be any relapse in the price of zinc, the companies will find it most difficult to make both ends meet. The managers of some of the mines also complain that they are not getting the efficiency from the men that they expected when the increased wage was adopted. The amount of work done does not increase with the prospect of better earnings, so it would almost appear as if the miners were not doing more than a fixed quantity of work, thus to establish a maximum wage for themselves. Every effort is being made to induce labour from other countries to go to Broken Hill to combat this passive resistance.

MEXICO.

Lucky Tiger.—It is reported that English interests have obtained control of the Lucky Tiger mine in Sonora, through the purchase of some stock and a combination with other holders. This is one of the principal gold properties of northern Mexico. The concern owning and operating it is known as the Lucky Tiger Combination Gold Mining Co. with headquarters at Kansas City. Up to this time Kansas City men have been principally interested. The company has been a steady shipper of ore and concentrate over the Nacozari railroad to Douglas, Arizona, and good dividends have been paid. The concentrating plant at the mine has been remodelled and enlarged to 200 tons daily, and a 250-ton cyanide plant has been installed. Construction is nearing completion, and the new reduction equipment will soon be available. A power-transmission line from the Copper Queen smelter at Douglas to the Lucky Tiger mines, a distance of 65 miles, has been completed, and current for mining and milling will be supplied within the next 30 days.

Mines Co. of America.—This concern, now controlling the Dolores and El Rayo properties in Chihuahua, and the Creston Colorado and La Dura properties in Sonora, shows profits of \$1,061,164 for the calendar year 1910. The profits are credited as follows:—Dolores, \$426,513; El Rayo, \$374,821; Creston Colorado, \$218,500; La Dura, \$41,329. The total gross value of the ore reserves at the end of 1910 was estimated at \$5,623,508, divided as follows: Dolores,



The State of Chihuahua, Mexico.

bourne capitalists to take a shot at some of the northwest Tasmanian tin deposits. These are found on a big fracture zone at Dundas, and the idea is to test the lodes, to prove their extent and whether they are amenable to cheap treatment. The statement publicly made is that Bowes Kelly and those associated with him are to secure the services of an expert of the same calibre as Robert Sticht of the Mount Lyell company. Where they are to put their hands on him is not quite clear, but the announcement shows that the scheme is a genuine one and that there is a desire to avoid initial mistakes.

Broken Hill.—The last lingering trace of labour trouble at Broken Hill appears to have

\$1,875,288; El Rayo, \$889,300; Creston Colorado, \$1,750,000; La Dura, \$1,108,060. The Mines Co. of America has been operating the Creston Colorado mines in Sonora for several years. Last year a merger was effected with the Dolores Mines Co. and the El Rayo Mines Co., operating in Chihuahua, and the La Dura mines and mill, in the Yaqui River region of Sonora, were purchased. The present capital is \$9,000,000. During the last year operating costs at the Dolores, El Rayo, and Creston Colorado have been reduced. Arrangements are being made to increase the capacity of the Dolores reduction plant and to install new equipment at La Dura.

Pachuca.—Operations in Mexico's principal silver district have not yet been hindered by the political upheaval in the Republic. However, precautions have been taken, forces having been detailed to guard mining properties and the transmission line that supplies power to the mines and mills. The Real del Monte is going ahead with its scheme of betterments, and as soon as the enlargement of the Guerrero mill is completed this company will be in position to handle 1350 tons of ore daily. The new plant of the Santa Gertrudis is about ready for operation. The Guadalupe plant of the Santa Gertrudis, which has been in operation over a year, is now receiving power from the Necaxa line, and the Cubitos steam plant has been shut down. The rebuilt Purisima Grande reduction plant, of the Guadalupe-Fresnillo Co., was recently started. The capacity is 100 tons daily. Excellent results are being shown by the San Rafael and La Blanca companies.

The Alvarado Mining & Milling Co., of Boston, has acquired the Parral district mines formerly owned by the Hidalgo Mining Co., at a price of \$500,000. These properties, together with control of the Parral & Durango railroad, were taken over some months ago by men principally interested in the Alvarado enterprise. To make the purchase and pay off \$350,000 in notes of the Alvarado Consolidated Mines Co., the Alvarado Mining & Milling recently issued \$1,000,000 in 5-year 6% convertible gold bonds. The Alvarado Consolidated and the Palmilla Milling Co. were merged in the present concern. The Alvarado reduction plant is now handling from 250 to 300 tons daily, and it is hoped to increase the amount to 400 tons within the next few months. The dump ore at the Palmilla mine and at the Hidalgo properties is sufficient to keep the plant busy for a long period.

It is planned ultimately to increase the reduction capacity to 1000 tons daily, but it is stated that there will be no enlargement until ore supplies for 10 or 12 years are assured. There can be no development below the water-level in the Palmilla mine until powerful pumps are installed.

Amparo.—The State of Jalisco at present has but one dividend-paying mining concern. This is the Amparo Mining Co., of Philadelphia, operating in the Etzatlan district. The annual report shows that in 1910 the mill was in operation 349 days, crushing 68,217 metric tons of ore. The total value of the concentrate, bullion, etc., was 1,439,666 pesos, and the operating expenses 822,896 pesos. A 10% depreciation charge was made, and the net profits for the year amounted to 563,054 pesos. The net return from the company's store was 26,568 pesos, and from the company's ranch 7283 pesos, making a total profit of 596,905 pesos. The company paid 12% on a capital of \$2,000,000.

NEW YORK.

Changes in the offices of the American Institute of Mining Engineers have been announced. Dr. R. W. Raymond, whose long and distinguished service as Secretary has done so much to place the Institute in the front rank of technical societies, has resigned active control and been made Secretary Emeritus. It is understood that he will still devote his talents to the Institute but that the main responsibility will hereafter be shouldered by Mr. Joseph Struthers, his long-time assistant. Plans for enlarging the activities of the Institute have been discussed by its officers, since there is a general feeling that in some ways the society has not lived up to its opportunities. The organization of the Mining and Metallurgical Society of America, the growth of the American Mining Congress, and the action taken recently by San Francisco members looking toward organization of a local section of the Institute, are all quoted as evidences of a need that is not met by the Institute. The headquarters and staff maintained in New York are large and expensive, and many members who seldom or never visit that city have thought that the Institute has become too centralized. At the same time the conduct of a national society, whose members are necessarily widely scattered, is none too easy under any conditions, and, however better it may be conceived that things might have been done, there is unanimous agreement that they have been done well. The

Institute is to visit the Pacific Coast and Japan in October, and the new secretary and his fellow officers will have excellent opportunity to consult with members away from New York. No one familiar with the personnel and history of the Institute doubts its ability to meet changing conditions as they arise.

Congress is in special session and the Canadian Reciprocity Bill will pass. So much may be safely predicated. What else will eventuate is less certainly foretold. Tariff revision will be much discussed, but what legislation, if any, will pass is uncertain. No move has been made as yet to touch any of the metal schedules, attention being concentrated on wool and food-stuffs. The pressure for revision is coming largely from the farming States, where the high cost of living has been keenly felt. It is singular that the first schedules up for revision, cover the products of the insurgent States; such, however, is common in politics.

Scranton, in the heart of the anthracite region of Pennsylvania, has had to take serious account of the danger from unfilled mine workings that exist beneath the town. Messrs. Eli T. Connor and William Griffith were employed to investigate the underground situation. These gentlemen have been working for the past four months, and their report was recently submitted to the advisory board. From the statistics given in this report, it is estimated that the coal supply under the city of Scranton will last for 21 years, if the present rate of production is kept up. During the year 1910 there were 6,000,000 tons mined from under the city. The original area of the mines was 58,110 acres. There have been excavated for mining, 17,332 acres, and pillars excavated total 8654 acres. The foot-acres mined are 184,418. The foot-acres excavated excluding pillars are 122,970. Foot-acres to be excavated, leaving one-third for pillars, total 91,266. The production per foot-acre averages 1440 tons. At this rate, there remains under the city for mining, leaving one-third for pillars, 131,336,640 tons of coal, which at the rate of present production—6,000,000 tons per year—would be mined out in something over 21 years. If the one-third left for pillars were mined, the supply would last for 10 years more at the present rate of production. The engineers recommend as a means of saving the surface, the flushing of sand, culm, and ashes into the mine workings. The reports also suggests that in some localities, the blasting method of filling veins of a

thickness of over six feet may be adopted at small cost. It is estimated that the cost of flushing culm, including the erection of necessary plant, will be \$4 to \$5 per foot-acre below the river-level, and that the cost of flushing sand either above or below the level of the river, will be \$1615 per foot-acre. The cost of the flushing plant is estimated at \$500,000. The report shows that less than 15% of the city is endangered by mine caves. The report will be published by the Bureau of Mines, including the maps, tables, and recommendations. In the meantime further studies will be made by officers of that Bureau, and G. S. Rice is to be sent to Europe to study methods and costs of flushing waste into mines. The matter is of general interest as being the first comprehensive attempt in the United States to study one of the serious problems of mining. Incidentally, the report excited comment in that it is shown that the space excavated under the city is about 198,000,000 cubic yards. The total estimated excavation on the Panama Canal is 175,666,595 cubic yards.

Lead.—Complete figures covering production and consumption of lead in the United States in 1910 have been collected by C. E. Siebenthal of the U.S. Geological Survey and are now available. Mr. Siebenthal's preliminary estimates, made public at the beginning of the year and published in your February issue, prove to have been remarkably accurate forecasts. The total production of refined primary lead was estimated then at 469,682 tons of 2000 lb., and proves now to have been 470,380 tons. The total supply available for consumption was estimated at 504,749 and proves to have been 498,240. The other figures present such close agreement with the estimates that it is unnecessary to repeat them. Mr. Siebenthal's statement is of particular interest since there are no other authoritative figures of production and consumption of lead in the United States. The Guggenheims, through the A. S. & R. Co., Federal, and National companies, dominate both the producing and marketing branches of the business. In 1910 while production increased 22,268 tons, equivalent to 5%, the amount available for home consumption increased but 6008 tons, or 1'6%. As before, Missouri held first rank among the producing States with an output of 161,659 tons. Idaho was second with 99,924, and Utah third with 57,081. The soft-lead districts of the Mississippi Valley continued to increase their lead on the silver-lead districts of the West.

PERSONAL

FRANK BAILEY, lately in British Columbia, is at St. Leonards, Sussex.

J. F. BALFOUR, formerly on the Gold Coast and the Straits Settlements, is now in Nigeria.

A. CHESTER BEATTY is here.

L. K. BEAROW has returned from the Frontino mine, in Colombia.

F. L. BOSQUI has been appointed chief metallurgist to the Rand Mines, in succession to WILLIAM K. BETTY, who retires and has just arrived in England.

WALTER BROADBRIDGE is now with the Minerals Separation Co., at 62 London Wall.

GELASIO CAETANI is here on his return from Rome to San Francisco.

EDGAR A. COLLINS has resigned as manager of the Montana-Tonopah mine, to accept an appointment in South Africa.

J. J. COLLINS, who recently arrived from Nigeria, is returning as manager for the Tinfields of Northern Nigeria.

A. SPENCER CRAGOE has returned from Parral, Mexico.

THOMAS A. DOWN has returned to Tavistock from Minas Geraes, Brazil.

H. T. DURANT has severed his connection with the firm of Hommel, Durant & Co.

A. W. EVANS has been appointed manager for the group of mines controlled by the Consolidated Goldfields of New Zealand.

W. F. FERRIER has established himself at Toronto.

J. R. FINLAY has resumed general practice at 52 William Street, New York.

W. E. GORDON FIREBRACE has left for Brazil.

HARRY D. GRIFFITHS, the manager of the Tronoh mines, in the Federated Malay States, is in England.

JAMES M. HALL is at Valdez, Alaska.

HENRY HAY is now manager for West African Mines.

R. B. LAMB, of Toronto, has been appointed consulting engineer for the Swastika mine in Ontario.

W. H. LANDERS has resigned as superintendent of the Standard mine in California, to engage in mining at Independence in the same State.

A. N. MACKAY has returned from a long engagement in Mexico.

MALCOLM MACLEAREN is returning to London by way of New Zealand.

J. E. MARRINER is leaving for the Malay States, to become general manager for the Pahang Consolidated.

C. H. MUNRO left San Francisco for Nikolaievsk, Eastern Siberia, on April 18.

ARTHUR ONDERDONK, engineer to the Abangarez Gold Fields of Costa Rica, is in London on his wedding journey.

WALTER G. PERKINS left on May 8, returning to Kyshtim, in Siberia.

F. PERRY has been appointed resident manager for the Butters Salvador Mines.

J. H. RIDGE has succeeded A. M. ROBESON as consulting mechanical engineer to Eckstein & Co.

JOHN SAXTON, manager of the Eastern Akkim mines, has arrived in London from West Africa.

FREDERICK H. SEXTON, Director of Technical Education in Nova Scotia, is making a tour of inspection in Europe.

S. F. SHAW was here from Costa Rica.

HOWARD D. SMITH, recently in the Tampico oilfield, has returned to London.

RICHARD B. STANFORD has resigned his connection with the Siempre Viva Mining Co. and will devote himself to private practice in Nicaragua.

O. J. STEINHART and H. L. TWITE have formed a partnership with offices at 65 London Wall.

L. C. STUCKEY has gone to West Africa as mine superintendent of the Taquah.

THOMAS A. TURNBULL will leave New Zealand to come to London in July.

ARTHUR WILKINSON is expected shortly from South America.

HORACE V. WINCHELL, on returning from Cuba, has gone to Montana.

E. R. WOAKES left for Cape Town on May 6 to take temporary charge for the Cape Copper Company.

L. A. WOMBLE, lately manager of the Princess mine, has been appointed general manager of the Geduld Proprietary.

JOHN A. WOODBURN, manager for the Messina (Transvaal) Development Co., has returned to the mine.

HERBERT C. WOOLMER, manager of the Spassky, is here on a holiday.

DISCUSSION

Our readers are invited to criticise anything appearing in this magazine and to discuss other subjects of general technical interest.

Waihi Geology.

The Editor :

Sir—In the proceedings of the Australasian Institute of Mining Engineers for August 1910, I find a paper by James M. Bell on the Waihi goldfield. In view of the recent public uneasiness concerning the Waihi mine's lower workings, and the consequent attention drawn to this remarkable ore deposit, there are a few points in Mr. Bell's paper to which I desire to direct attention.

On page 85 he says : " In the 1000-ft. level the mine is as yet scarcely one-third developed. The shoot of ore on the Martha is less continuous and not so wide as at high levels, but apparently the average tenor of the milling ore is not diminished. The values on the Martha, which, in the upper levels, were confined chiefly to the foot-wall, are in the 1000-ft. level mainly on the hanging wall, being underlain by a great thickness of calcite, and quartz, pseudomorphic after that mineral. The foot-wall is inclined to be soft and shaly, unlike the hard, propylitized rock which is apparent at the levels overhead."

In the discussion that followed the reading of this paper, F. Danvers Power said that miners at Waihi generally think that the presence of calcite means that they are getting near the bottom of the vein. In reply to his question : " Is there any reason why they should think that?" Mr. Bell said that the reason why the miners think that calcite means the end of the vein, is because at the Golden Cross mine at Waitekauri the ore ceased to be profitable when a floor of calcite appeared. Instead of going below that floor to see if anything further existed, in the case of the Golden Cross, but little further prospecting was done, and a mine formerly good was abandoned. Mr. Bell pointed out, however, that in the Golden Cross the calcite appeared at all the levels of the mine, whereas in the Waihi it appears only slightly in the levels above 1000 feet.

Waldemar Lindgren (*Engineering and Mining Journal*, Feb. 2, 1905), referring to the origin of the Waihi deposit, says : " What has taken place is probably this: Descending surface waters have dissolved and carried away the calcite; secondary deposition of quartz and chalcidony has accompanied this process; simultaneously the pyrite and zinc-blende have been oxidized and carried away as sulphates.

The gold has remained in finely divided state; the silver has been re-deposited with chalcidonic quartz as argentite. These developments in the Waihi emphatically contradict the opinion often heard in the Hauraki goldfield that impoverishment necessarily follows the appearance of the primary calcitic ore, and they must be accepted as a favourable sign for the persistence of the orebodies to greater depth than yet attained."

It should be remembered that Mr. Lindgren inspected the mine when it was not greatly developed below 500 ft. On the 500-ft. level he noted abundant platy quartz, evidently pseudomorphic after calcite. The original calcite had been carried down in solution, and perhaps re-deposited at greater depth by change in physical conditions. The De Lamar mine in Idaho presented almost the same gangue material as the Waihi, with the exception that calcite was not present, as it had apparently all been removed leaving the lamellar quartz pseudomorphic. The end of the ore-shoot in depth at 600 ft. in the De Lamar occurred before any calcite was encountered.

The abundant appearance of calcite, whether original or re-deposited, at the 1000-ft. level on the Martha lode should not, in my opinion, be accepted as evidence of final impoverishment in a deposit presenting wide ore-fissures. The appearance of the "soft shaly rock" mentioned as forming the foot-wall at this depth is probably a feature intimately connected with the appearance of the calcite in the gangue. If lime has been at this point removed from mineral constituents of the wall-rock and deposited in the open fissure that now forms the vein in large quantity, then the occurrence of the calcite mass may represent the result of more energetic hydrothermal and ore-forming action than has occurred at any point above. The wall-rock would then be analogous to the 'iron dike' of the De Lamar.

Be this as it may, it seems incredible that a local rule-of-thumb opinion, which cannot be regarded as more than a prejudice, should be allowed to influence the policy of development in depth. It is also highly improbable that great ore-filled fissures should at once change at a definite horizon from profitable to unprofitable ore, under geological conditions such as exist at Waihi.

Other factors may of course have an influence in forming the decision as to whether the mine can be worked to greater depth. Heavy inflow of water, impossible to cope with, or increased temperature, might render mining impossible. It does not appear, from

published report, that such absolutely prohibitory conditions have been yet encountered.

In the articles that have been published on Waihi geology there is a considerable difference of opinion as to the origin of the veins. For example, P. C. Morgan (Aus. Inst. M.E., Vol. 8, p. 168) says that the strike of the veins is usually northeast and southwest, but ranges from north and south to east and west. Such a statement means nothing. It is easy to see from the plan of the No. 8 level published in Mr. Bell's paper that the Martha, Empire, and Royal veins follow alternately two sets of northeast fractures, N. 65° E. and N. 41° E., while the Edward lode; the so-called north branch of the Royal; and the Rex follow N. 18° E. fissures.

Such statements occur in Mr. Morgan's paper as "many of the reefs in the district widen as they go down," and in the vertical cross-section published by Mr. Bell the Martha, Welcome, Regina, and Magazine veins come together at or above the seventh level, owing to converging dips. This geologist, replying to a question asked by E. C. Barton, said that the original fractures were very thin, and not straight for any distance, resembling forked lightning. Mr. Lindgren, on the other hand, says that the Martha is a wide lode, consisting chiefly of quartz filling, with subordinate amounts of metasomatic quartz, and calls attention to the fact that the quartz merely mixes with the rock of the walls in brecciated zones with abundant and *sharply outlined* inclusions of country. Further, he says: "The whole vein formation indicates, by a lack of compressive stress phenomena, that large cavities were probably opened near the surface at the time of vein formation."

Messrs. Bell & Fraser (*Canadian Mining Journal*, Aug. 15, 1908), differ widely from Lindgren in their idea of the origin of the ore, as they say distinctly that "metasomatic replacement, rather than the filling of pre-existing open spaces, seems to have been the more important," yet they consider that determining fissures did exist, as may be inferred from the rather vaguely worded statement: "Metasomatic replacement of the country rock may be considered to have proceeded gradually from the more or less parallel fissure of each individual zone." Moreover, all observers agree that the greenish lamellar quartz, with which the richest gold ore is associated in the sulphide zone, was deposited in open spaces.

The following extraordinary feature is noted with reference to the great cross-vein: "The Edward vein was discovered at the 700-ft.

level on driving west along the Empire, and was afterward traced upward to a point 40 ft. above the 445-ft. level, at which point it feathers out to zero. The vein, which runs nearly north and south, connects the Welcome and the Royal. In the 700-ft. level the pay-shoot has a length of 750 ft., and a width varying from 3 to 18 ft. In the 850 ft. level the vein has improved greatly both in dimensions and ore-values. It varies in width from 27 to 92 ft., and averages not less than 54 ft. At its point of maximum width, some 250 ft. south of its junction with the Welcome, the vein bifurcates, 16 ft. of material forming the eastern, and 6 ft. the western. These two branch-veins themselves fork, the larger forming two veins, 16 ft. and 15 ft. wide respectively, and the smaller two veins, each 6 ft. wide.

Now, although such a complexity of veins might be assumed to conform to the "forked lightning" simile of Mr. Bell, there is, unfortunately, a law controlling the fracturing of brittle volcanic rock-masses to be considered. Phenomena of this character do not merely happen; they are the definite result of forces. Veins in other countries do not widen as they go down, nor are they apt to come together in depth. They may do it at Waihi, but I doubt it. Powerful fractures, leaving sufficient open space to form, when ore-filled, some of the widest productive veins known in the history of mining, follow definite planes of shearing, both in strike and in dip. It is not credible that the Waihi veins converge and join in depth. Neither is it credible that all the ore-bodies above the 1000-ft. level have been discovered. Two veins converging either in dip or in strike, must eventually intersect, and again diverge, after the line of intersection is crossed. The pay-ore may shift from one to the other at the intersection, but this is no reason why both planes of fracture should not be thoroughly explored, either in depth or in horizontal extension, as the case may be.

It is impossible to believe that the vertical cross-section shown on page 84 of Mr. Bell's recent paper gives a complete idea of the Waihi fissuring. The plan of the workings at the 850-ft. level, the only detailed one I have been fortunate enough to see, gives clear evidence that Waihi fracturing is the result of a far-reaching force applied from an external source to a brittle mass of rock. While thoroughly agreeing with Mr. Lindgren, from the evidence presented, that large cavities were formed, afterward ore-filled, I regard it as important to ascertain the cause of the formation

of these cavities. A difficult but entirely solvable problem in rock mechanics is presented. It is worthy of something better than the off-hand treatment to which it appears hitherto to have been subjected. Judging from the published reports of present and contemplated development work, it is apparent that a considerable amount of money is being spent in cross-cutting and that the further sinking of the main shaft is proposed. Dead work in hard rock is an expensive business. Is it not justifiable to ask upon what systematic scheme the present and proposed development work is being, and is to be, conducted? Nothing in the published records of the mine show, so far as I can ascertain, that such a scheme has been elaborated. Were the affair one of only academic interest, the discovery of the key to this geometrical and geological puzzle might result only in an intellectual satisfaction to the investigator, but when it is considered that the correct interpretation may open the door to hidden ore-bodies in a magnificent mine, making a difference of hundreds of thousands of pounds to shareholders a scientific study of the Waihi ore deposit must be of material interest.

C. W. PURINGTON.

London, May 2.

Rhodesian Mines.

The Editor :

Sir—As one of the many Rhodesians who have welcomed the entry of *The Mining Magazine* into the domain of technical literature, and have been accustomed to accept without question as fair and unprejudiced the comments it contains, may I be permitted to express my surprise at the many glaring inaccuracies in the statements regarding Rhodesia which appear in your February number?

I may first of all point out that the vertical depth of the Globe & Phoenix is not 2600 ft., as stated, but about 800 ft. less, which makes the prospects of the mine so much the brighter, though it increases the journalistic error to which attention is drawn on page 83. While on this subject it may be mentioned that the dividend yield of the concern is well over 10% even on the present market valuation. As the value of the ore reserves has gone up at every half-yearly valuation for some time past, and the high grade of the lowest levels is being well maintained, there does not seem any very exaggerated optimism in the latest quotation. Indeed, the whole of your indictment of the "Rhodesian boom" (out here we thought it had been over for some time past!) is vitiated by several mis-statements. Eldorado share-

holders will, for instance, rub their eyes on reading that their shares are worth £8. The real figure is about £3 and the market valuation about £1,000,000, instead of £2,400,000 as you state; a vast difference when it comes to calculating the yield to investors, which is about 10% instead of 3 $\frac{3}{4}$. The profit in sight on this mine is equal to a large proportion of the market valuation, and the consulting engineer, Mr. H. E. Jones, whose conservatism is well known, promises a higher grade and larger profits for the future, on the strength of the extremely favourable developments on the lowest levels. With regard to Giants, your comment on page 84 entirely overlooks the facts that 80 feet is not an abnormal width for the Giant lode, while the statements as to dividends and yield also ignore the fact that the mine has only just resumed crushing from the underground stopes, after having had to mill low-grade surface stuff for two years pending the sinking of a new main shaft to replace the one that collapsed. You carp at the inclusion of the Charter Trust in the list of Rhodesian dividend-payers, but what about the exclusion of the much larger sums earned from Rhodesian operations by the Consolidated Gold Fields and other big concerns? Progress in Rhodesia, despite statements to the contrary, has been amply reflected in dividends; £906,000 for 1910 as against £421,000 for 1909.

I can only express my utter bewilderment at the statements under the heading of 'Labour in Rhodesia.' After ten years of Rhodesian experience, and speaking from a personal knowledge of nearly every big mine and a large proportion of the small ones, I can most emphatically contradict your statements in regard to the engagement of natives and contractors generally. Natives are always engaged directly by the mine managements, either locally or through the labour bureau, and contract systems are almost unknown on any of the mines. On the larger ones the sinking of shafts is about the only operation ever let on contract and this system has here the obvious advantage of speed. On the smaller properties the only circumstances under which contracts are ever likely to be let is in cases of purely preliminary prospecting, when the maintenance of a regular staff would obviously be most uneconomical. As for excessive amounts being paid, I can also assure you that the experience is rather for contractors to come in and ask for higher prices, on the ground of losing money, and throwing up their contracts if this is not allowed. Considering

the well known inefficiency of coloured labour, Rhodesian working costs have been reduced to a remarkably low level—17s. 7½d. per ton on the average, according to the recent address of the President of the Chamber of Mines. We pay considerably lower wages than on the Rand, and the expected re-organization of the labour bureau is likely to lessen recruiting costs materially. In conclusion, I should like to emphasize the statement I made recently in an article contributed to the *London Times*, that the technical direction of Rhodesian mining enterprises has little to fear by comparison with any other gold-mining district of similar standing. Leaving out market considerations as a purely side issue, it may be confidently asserted that the Rhodesian mining industry is in a very satisfactory state.

F. P. MENNELL.

Bulawayo, March 14.

[We are glad to publish Mr. Mennell's letter, which unfortunately arrived too late for our April issue. Not being infallible, but endeavouring to be accurate in giving information through the medium of this magazine, we welcome such letters from members of the profession. A reasoned protest or criticism from a thoughtful reader is more acceptable than a careless compliment. Replying to Mr. Mennell's remarks: As to the dividend yield of the Globe & Phoenix, we stated it to be "slightly over 10% on the 5s. shares when quoted at their recent high price of £3." This is correct. On the price (£2¾) at the time of writing the dividend yield is slightly over 11%. But the gross value of the ore reserve at £1,268,950 represents only about £680,000 certainly available for dividends, so that the mine has less than three years dividends (at the rate of 11% on 200,000 shares of 5s. each valued at £2¾) assured from ore measureable at this time. Mr. Mennell may consider a Rhodesian gold mine a good buy on a three years' purchase; we do not. We regard such a purchase as a rank gamble, and any suggestions to the contrary are only likely—even if not so intended—to mislead the untechnical public. The £8 for Eldorado shares was a mistake, due to a typographical error in the list on which our comment was based. It should have been £3, as is shown on page 183 of our March issue. Our complete detachment from share speculation has its drawbacks. We did not refer to the 80 ft. width of ore in the Giant as abnormal. The joke apparently was misunderstood. The reference was to the absurdity of stating a big width without giving other dimensions, par-

ticularly length. A month had elapsed since the cross-cut had penetrated the ore but further details had been withheld. Mr. Mennell will forgive us for demurring to his general tone of correction. Our meaning was perfectly clear, namely, that the dividend yield of the principal mines ought not to be stated in terms of the nominal capital but in terms of the market valuation at which shares have mostly been purchased by the public and at which now they seem to Mr. Mennell to be worthy of purchase. We insist that the good developments and improved prospects have all been over-discounted on a sane investment basis, and that the effort to boost these leading 'counters,' in market parlance, means that the shares can be taken by the public only on the basis of a wild gamble. And we say this in the best interests of mining in general and of Rhodesian mining in particular.

As regards the depth of the Globe & Phoenix shaft, we telephoned to the secretary of the company and asked him for the exact measurement. He replied that it was 2300 feet "at the last report," namely, in December. We may be pardoned for assuming that the shaft is vertical, for the maps published with the annual report do not give the required information. A plan and section should be given, together with a clear indication of the ground remaining available for stoping. The 'stoping plans' published are quite useless; any engineer submitting such drawings with a report on a mine for purchase would be considered incapable of presenting facts intelligently. We would like Mr. Mennell's opinion on this point. We would also like to ask him whether the gross value of ore in a mine indicates its earning power, unless accompanied by a clear statement in regard to the recovery and the cost—not the cost at the mine only, but the entire deductions to be made from the yield before earnings can be expressed in terms of final profit available for dividends. As a mining engineer desirous of doing what is right, Mr. Mennell will, we feel sure, be glad to give a frank reply. If he agrees to the propriety of giving information clearly to shareholders and not merely of going through the motions of giving information, he will tell us what is the average recovery at the Globe & Phoenix, and what is the total cost at this time. He cannot get it from any plain statement in the annual report. Again, we ask him, would he advise a client to buy a gold mine in Rhodesia on the basis of three 11% dividends assured, that mine being already 1600 feet deep

and subject to little irregularities of geological structure such as intersecting dikes?

In regard to our remarks on the labour question, we make no apology. Our information came at first hand from a mine manager just returned from Rhodesia and an engineer of unquestionable integrity and intelligence. Mr. Mennell's testimony, however, is valuable, and our readers can put it against that of his fellow professional.

In regard to the general technical direction of mining enterprises in Rhodesia, we accept Mr. Mennell's view that it is excellent. We deny, however, that the information supplied by the companies, as coming from their technical advisers, is such as a mining engineer would give to his client. Most of it is expressed in cryptic terms, it obscures rather than informs, and it is quite inadequate to give even an experienced miner—let alone an ordinary shareholder—a true idea of the actual condition of his property.—EDITOR.]

Prospecting in the North.

The Editor :

Sir—Mr. Winchell, in his article 'Prospecting in the North,' published in the December number of *The Mining Magazine*, discredits in a general way the prospects in British Columbia and Alaska and presents a theory intended to show that many of the ore deposits in these northern districts are but superficial phenomena likely to lead the prospector astray, as well as the mining engineer. Mr. Winchell refers to many of the discoveries as being orebodies without downward extension "which are purely superficial and a result of so much surface concentration as could have been found under the unfavourable conditions of climate and topography already described and within the few thousand years that had elapsed since the retreat of the last ice sheet" . . . "the sulphide ore outcrops immediately at the surface and is usually not of high grade to any considerable depth." He then notes the lack of secondary enrichment in northern latitudes in comparison with that encountered further south and brings out some interesting facts as regards the reason for this.

The lack of secondary enrichment in the ore deposits of southeastern Alaska is quite evident and in only a few instances have I noted the presence of such enrichment in depth, namely on Prince of Wales island at the Copper Mountain mines, where copper carbonate ores extend to a depth of 300 ft., and at the Goodro Mine, where native copper,

chalcocite, and bornite extend for at least 200 ft. in depth below which chalcopyrite occurs. (For descriptions see *Bulletin U. S. Geol. Survey No. 347*, 1908.)

With few exceptions the ore deposits known to me as having been discovered in southeastern Alaska are to be classed as primary deposits. Those of gold ore generally occur in well defined lodes or mineralized intrusive dikes (such as at the Treadwell mine); those of copper ore are found in lenticular veins and in irregular mass deposits at the contacts of intrusive and sedimentary rocks. All of these deposits are persistent in depth and show little or no difference in metal content at the surface or 100 ft. below the surface. In case of a mass deposit this may terminate at a shallow depth, but it is quite probable that a similar mass exists at greater depth.

The occurrence of post-glacial superficial deposits, as described by Mr. Winchell, is most interesting but I believe it to be exceptional and local. The description is not applicable to any of the copper and gold deposits I have seen in southeastern Alaska.

CHARLES W. WRIGHT.

Iglesias, April 16.

The Editor :

Sir—I am honoured by the attention of Mr. R. W. Brock in your issue for March. My sense of obligation would be greater if my critic had read my little article with care sufficient to gather the ideas which I attempted to convey. That he did not do so must be due to its ambiguity or lack of definite statement. The points urged against me are :

1. That there are more vein-fractures in northern regions than I gave them credit for possessing.

2. That instead of a zone of rock-decay of minimum depth at the Pole, and increasing toward southern latitudes, there may be a "hydrosphere relatively deep in the north."

3. That I "assume that glacial conditions have always existed in the glaciated area."

4. That contrary to my theory "the greatest iron, the greatest copper, the greatest nickel, and one of the greatest silver districts in the world are all in the glaciated zone."

To these objections I may say :

1. That "dike-filled fractures" are not vein-fissures, nor do they usually suggest the presence of those physical conditions under which mineral veins are formed. Their very existence in so large a number that "it is difficult to find any wall-rock" does not to my mind predicate in any way the occurrence also of

fissures likely to contain ore. But even admitting the existence of occasional areas of intense shattering, and numerous veins, I must adhere to my view that as compared with almost any large area of mountainous country in Mexico there are not so many vein-fissures in an average equal area of Alaska or Canada.

2. I am unable to find any synonymous relation between "hydrosphere" and a zone of oxidation or rock-decay. Nor did I in my article suggest a "hydrosphere varying from zero at the Pole to a maximum of a thousand feet at the Equator." According to Chamberlin and Salisbury ('Geology,' Vol. I, page 8) "Besides the ocean, the hydrosphere includes all the water which constitutes the surface streams and lakes, together with that which permeates the pores and fissures of the outer part of the solid earth." Lake and Rastall say ('Text-Book of Geology,' 1910, page 5) "The Hydrosphere: This includes the whole body of water existing as such on the surface of the globe and in the interstices of the lithosphere." According to Scott the hydrosphere is the ocean alone ('Introduction to Geology,' 1907, page 5). The Oxford dictionary defines hydrosphere as "the waters of the earth's surface collectively. By some used to designate the moisture contained in the air enveloping the earth's surface (*Cent. Dict.*)."

I am apparently accused of suggesting ore deposits in the ocean or of discussing the geology of the body of *water* which envelops the globe or possibly of the atmosphere. I most emphatically disclaim any such conception as to the natural habitat of ore deposits. Here indeed my critic might have employed a dictionary as well as a little chemistry.

3. Diligent search throughout my article fails to disclose any basis for this criticism. Instead of assuming that glacial conditions have always existed in the north, I refer to "the destructive effect of the continental ice-sheets" upon ore deposits formed and oxidized prior to the glacial period. And I specifically call attention to the partial sweeping away of some of "the iron ore-beds of the Mesabi range by the ice-sheet" as an illustration of the occasional relation between glacial geology and the study of ore deposits.

4. The final paragraph of my article states that "these remarks as to the genesis of ores apply, of course, to veins and deposits of sulphide ores of copper, silver, and lead, and, to a less extent to gold. *They do not apply to native copper deposits* like those in the Lake Superior region, to *iron ore deposits*, nor to

gold placers." There must be some undiscussable ambiguity in this statement, for Mr. Brock attacks my views because of the very things against which I here attempted to guard. He says "the greatest iron and the greatest copper districts in the world are in the glaciated zone"; and the reader of his remarks, knowing his statement to be fairly accurate, and perhaps not having my own article at hand for immediate reference will at once decide that a point is being conclusively made against me. I agree instantly and wholly with the statement as to the iron ore districts thus far developed; although the Brazilian iron ore-fields, in unglaciated regions, probably far exceed the Lake Superior region in the extent of their iron ore deposits. I am unable to decide to which of the copper districts Mr. Brock refers, whether that of Montana, which was until recently actually the greatest but is not within the area formerly covered by the continental ice-sheet, or the native copper district of Michigan, which I expressly excluded from the scope of my remarks. Moreover, the copper mines in the non-glaciated territory of Arizona have for four years produced more copper than those of Montana or Michigan, and are certain greatly to increase their supremacy in the current and succeeding years. Perhaps these are some of the "awkward facts" to which he alludes. As to the nickel and silver mines of Sudbury and Cobalt I have yet to learn that either of them is looked upon as presenting examples of secondary enrichment. If the mineralization at Cobalt is limited to as shallow a depth as is generally believed this district may in itself furnish a striking illustration of the truth of my theories.

I am sorry that Mr. Brock chose to interpret my remarks as a reflection upon Canada. They were not so intended nor so stated. I referred solely to the glaciated area without stopping to consider that the larger portion of it is north of the Canadian boundary; and Alaska was quite as much in my mind as Canada. My remarks were applicable chiefly to secondary enrichment and I distinctly stated that "where large deposits of *primary ore* are found in glaciated regions they are likely to extend downward." Secondary enrichment is ordinarily of recent date, not pre-Cambrian, middle-Cretaceous, nor always and altogether pre-Glacial. Its importance is beginning to be recognized; but quite naturally not yet in those countries where its beneficent operations have not been put into full force and effect.

HORACE V. WINCHELL.

Minneapolis, April 3.

THE FINANCE OF A MINE. I

By M. H. BURNHAM.

THE SOUND ESTIMATE OF THE VALUE OF AN INVESTMENT ASSUMES NOT ONLY THE RETURN OF THE CAPITAL AND 3% ANNUAL INTEREST, BUT A NUMERICAL ALLOWANCE OF INTEREST FOR THE RISK OF LOSS.

THESE three requirements must be fulfilled, in undertakings of a terminable life, from a series of annual payments. In turn, these payments result from the exhaustion of certain assets, usually blocks of ore.

Again, the valuation of these assets rests with the engineer on account of the technical nature of the work.

But this valuation may not be made until the capital to be sunk in plant is determined, as not only does this largely fix the costs of treatment and losses in extraction, but has in turn to be redeemed. Finally, the risk-rate to be allowed on this working capital is necessary to such calculations.

We see then that the engineer, from the very nature of his duty, has to deal with all the essentials of investment, the only difference between his calculations and those of the financier being that the latter deals with nominal capital as distinct from working capital. This difference arises from the payments to vendors and the perquisites of introduction and promotion. Thus we come to the point concerning which the two branches of the modern school of engineering take issue. It is not one of principle so much as one of expediency, for it were idle to deny the fact that the engineer must consider not only the attitude of his immediate financial chiefs, but face a larger public at a later stage. In plain English, it is the choice between immediate profit or conforming to shadowy community standards that become operative only through publicity.

We see then that the keynote is publicity, the tendency of the one school being to avoid this and remain officially oblivious to nominal capital; that of the other is to face the issue fairly and certify not only to the working capital, but to the amounts going to vending and promoting interests.

As a practical measure, this last course, if adequately supported and directed by financial principals, is a most powerful aid toward securing favourable terms from vendors, as it enables an engineer, if gifted with negotiating acumen, to assist intelligently in framing the

company's share issues so as to minimize the capital risked.

It may be as well to state that while the financier will obtain from the engineer the present value of the assets, as a guide, it should not be thought for a moment that the engineer's estimate can form a common basis for negotiation, except when all the arts of financial craft have been exhausted. In fact, it is after the mere engineer has made the estimate whereby to guide the professional financier, that the latter's work really begins; for he has many complex factors to overcome even if adequately assisted by an engineer grounded in financial principles and in contact with the vendors.

The financier has not only to check the engineer's suggested weighting of assets in terms of cash, debentures, preference and common shares, but to determine if and how these may be dealt with when issued: in fact, it would seem that careful finance, having in view the conditions of the mine, might easily reduce mining losses as much as intelligence in pure valuation. It will be seen that such a co-ordination of effort is possible only when, on the one hand, the financier has the real assets before him stripped of all childish technicalities, and, on the other, the engineer has a sound grip of the elements of finance.

Apart from those occasions when the engineer is fortunate enough to work with a financier both capable and sound, he has constantly to pass upon the value of shares for directors that are unskilled in mining finance and yet compose the major part of London boards.

Before the engineer can present the assets in adequate simplicity and before the financier can deal effectively with them, both should appreciate the significance of the risk-rate principle. The requirements from the yearly return on capital invested in any undertaking with a terminable life are that a portion be set aside to redeem capital: another to provide such interest as is paid by Consols (or 3%): and a third to meet the risk of loss.

Expressed in simplest algebra, this may be written:

$$\text{Formula I} \quad D = r' + r'' + r'''$$

where D is the yearly dividend (assumed to be constant); r' the Consol rate, or 3%; r''

the yearly contribution for capital redemption purposes; and r''' the portion set aside to meet risk of loss of either capital or interest.

Some will, of course, contend that the demand for a higher rate cannot protect against loss should the mine suddenly fail. While this is true in the case of a single investment, it does not hold good for several of the same class with similar risks, as in insurance. Again, one might soundly wager a sovereign that the ace of hearts would turn up first card when cutting the pack, providing 52 were paid in such an event; on the other hand, one would not think of taking the chance if only 10 to 1 were offered.

The aversion occasionally exhibited in some quarters to calculations of the annuity kind is based, by the more honest at least, upon the mistaken idea that those using them aim at definite valuation and overlook the possibility of unforeseeable events that may vitiate the result. As a matter of fact, *what is sought is an approximation of the odds for and against*, and this may be attained only by study and an intelligent use of such mathematical machinery as is applicable. As in a game of cards, a player should be judged by his calculations of the chances and not by the outcome of a rubber or two, though, of course, one unfamiliar with the principles involved will gauge the relative skill by the temporary position of the winnings.

Only the unobservant mind will fail to realize that the ordinary shareholder usually buys with a view to selling at an enhanced price, regardless of intrinsic value. On the other hand, this enhanced price is largely due to the general demand for shares. In turn, this demand in the long run will depend upon the very class of buyers who want both dividends and a gamble; who want such a run for their money as is represented by a return of their capital; or who can perhaps afford to forego the interest but not to sacrifice their principal for the inclination to back their judgment in correctly anticipating the credulity of their neighbours. But it all comes back to the same thing. The larger public comes in principally on the calculation of probability as determined by the technically skilful, namely, financiers and engineers.

The value to be given to the risk-rate (r''') in order to allow for variation in the selling value of other metals than gold, is worth more than passing thought, and while it may be discussed more exhaustively later, it will be mentioned here. Sometimes we see that copper shares, for instance, are purchased at such

figures as to bring the interest paid by a company producing copper at £50 per ton, to the same basis as one producing at £30, when the selling price of copper is, say, £60: this in spite of the fact that a fall of £10 in the price obtained for the metal will cut off dividends entirely from the one and only reduce those from the other.

As a matter of fact, while an exact adjustment of the risk-rate (r''') whereby to meet the vagaries of the metal market would be impossible, it will appear that the probability of a cessation or reduction of dividends would follow the ordinary probability law expressed by

$$\text{Formula II} \quad y = \frac{k}{x^n}$$

or possibly by

$$\text{Formula III} \quad y = \frac{k}{n^x}$$

where y is the probability of loss, x the difference between the cost of production of the metal and its mean selling price, while n and k are constants as determined by experience.

The unconscious allowance of a risk-rate is shown by the higher interest demanded from the issues of lesser or unstable governments. The application of such a risk-rate, however, while now and then touched in a gingerly and academic manner in technical proceedings, appears to have called for a degree of courage, or of consecutive thought, heretofore wanting save in the reports of a few of the abler men when confidentially advising their own 'houses.' It will be clear that the rate for risk must vary for the same property according to the person considering it. For instance: the 'man in the street' has to allow not only for all vicissitudes incidental to the class of undertaking, but for the knavery and incompetence of his family attorney, broker, or other financial adviser, as well as for those same qualities when found on a directorial board. The directors have to consider not only war, pestilence, famine, and cataclysm, political and physical, but the knavery and incompetence of the mining engineer: while the latter has to consider not much more than the risks incidental to marketing and mining the metal with which he deals and the vagaries of his particular deposit of ore. Hence his average r''' should be lower.

It is a source of constant wonder that people will invest in copper or silver ventures on the same basis as gold; that is, they will accept, say, 6% return on copper shares and ask the

same of gold. If such investors could bring themselves to abandon their self-humbugging frame of mind for a moment, they would no doubt admit that what they really want is share speculation, but in order to indulge themselves comfortably in such pastime, they seek to be told that it is 'investment.'

The value of r''' is essentially the practical measure of speculation, even though no exact line may be drawn.

Table I gives what appears at first sight to be the rate for r''' demanded by the public of four well-known Rand shares, the examples given having been taken at random. The amazing fact is demonstrated that buyers appear to be content to ask less of these mines than of standard railway shares, thus tending to confirm the cynical view that the public finds in mining only a convenient table upon which to gamble. While no doubt there is truth in this, the moment an engineer admits that he has no concern in providing a good return on capital, this essentially meaning $r' + r'' + r'''$, he becomes but a croupier in the game, as it were, and his position in society should be, and often is, so regarded.

TABLE I.

Company	Life in years	Rate of Dividend on par value	Rate paid on market value of share	Rate necessary to redeem capital	Rate compared with 3% Consols Higher - Lower
A	30	40	7	2	+ 2
C	8	30	14	11	0
D	16	35	9	5	+ 1
E	12	17	9	7	- 1

Average risk-rate: half of 1%.

* Figures taken from *The Mining Magazine*, March, 1910.

Reverting to Table I, showing the Rand risk-rate as apparently estimated by the public, one has to take several things into consideration before deciding what is demanded. First, ignorance of the effect of 'life' allowance in increasing the rate to be legitimately asked; second, the degree of risk run; third, the imperfection of the data upon which the investment was made; fourth, the disinclination of shareholders to reduce the value as set in a time of speculative hysteria when the major part invested; sixth, the hope that others still more foolish than themselves might yet take their holdings.

The very fact that the prices paid for mining shares often, if not usually, imply the loss of part of the capital embarked, demonstrates

the needs of the consulting engineer as a technical adviser whose first duty should be to estimate, however, approximately, the value of r'' and r''' . The use, disuse, and misuse of these two factors of the dividend equation furnish a convenient and accurate sieve whereby to classify our honourable profession. So far as London is concerned, one may say that those who use r'' and r''' in their daily calculations are few in number, unknown to many, and have status only as special advisers to the larger and more reputable concerns. Their light often has a bushel carefully kept over it, lest the public, learning of their existence, should demand their favourable reports on new ventures.

The engineers who disuse r'' and r''' are more numerous, while their powers and reputed foresight are ever kept in the 'lime-light' by those seeking favourable verdicts, both by the big 'houses' who employ them for public reports and by the Press, which sees nothing more important than the approval of the former. Usually the latter class are of the older school, often venerable of aspect and, what is of more weight, with as nice a sense of directorial propriety as of flotational needs. The third class, those who misuse r'' and r''' may belong either to the old or to the modern school; suffice to say that while some of them occasionally emerge from below into the class above, when a prospect recommended becomes a mine, their sphere of usefulness is too often of service only to those that make of mining a game affording the credulous an opportunity to gamble.

It may be contended that it is useless to employ a risk-rate when so many factors influencing it must remain undeterminate; as, for example, the various personalities effecting the enterprise. On the contrary, because of the possibility of the adverse factors synchronizing, as it were, it should be the more advisable to use it.

The varying weight given to the reports of different engineers is expressed to a certain extent by the market-values of shares in ventures recommended by them; this is an unconscious employment of a factor of safety, but expressed in terms of present value.

Where engineers check one another's work, a rate of risk applicable to each other can often be approximated. For instance, the results obtained from an inspection of a Chilean nitrate pampa indicated that by using the data of a careful examination at a few points as unity, the accuracy of an earlier report might be said to be 0.66. Again, in the examination

of a Mexican mine the errors found in the methods of sampling alone gave rise to the prediction that others yet more serious would be found in the block calculations. This was borne out in the next work, which, though uncompleted, showed an error of £80,000, as was admitted subsequently.

The proportion of the so-called 'positive' to 'probable' ore and of these to 'possible' ore, when a purchase is recommended, is one that must greatly influence the value to be given to r''' , and is often the best criterion of an engineer's qualities, moral and technical. The practical definition of each of the above classes of ore varies, the interpretation of the local data, geological and economic, largely affecting it and unfortunately giving an open-

out. The sampling of the latter calls for little more than a knowledge of mining as practiced or practicable locally, a good eye and a sound grasp of the principles of sampling and deductions therefrom; though the last is little enough understood, even by the fraternity.

From this aspect of r''' the probable occurrence of ore beyond the pick-point, whether it be the continuation of an ore-shoot in a typical vein, or the lateral extension of a mineralized part of the porphyry flow, though often calling for the most exhaustive study of the surrounding district, is the practical object of geological work. For instance, Mr. Hoover's idea that a fair allowance for shoot-extension would be a wedge having a base

TABLE II.

Classes of Ore	Part of block sampled	Amount Tons	* Net value £	Ratio of Value to Purchase Price	Ratio to Capital of Company
POSITIVE ORE :					
Block A	Patches	175,000	182,000	17%	14%
Block B	Top; imperfectly	55,000	112,000	11%	9%
Block C	Top and bottom	77,000	200,000	19%	16%
PROBABLE ORE :					
Blocks D & E	Half of top; virgin below	318,000	560,000	53%	61%
TOTAL: £1,054,000			First payment made: £1,000,000		

* Only the assay-value minus costs and not the true present value.

ing for many to introduce plausibly a contemptible misuse of terms and a skilful ambiguity leading to a successful promotional exploitation.

One may say that common practice among the more careful engineers often demands that the dividends from the 'positive' or four-sided ore must at least equal the Consols basis (*i.e.*, $r' + r''$), leaving the 'probable' to represent r''' and, one might add, the 'possible' ore, to give the zest so essential to embarking upon new undertakings.

We owe much to H. C. Hoover's courageous outspokenness, and his statement that 7% is the minimum to be given to r''' in any class of mine investment is well worth careful consideration.³² In a general way one may say that the estimation of r''' is that portion of the reporting engineer's work which makes the greatest demand upon his knowledge of economic geology; for on the above basis $r' + r''$ is covered by the ore actually blocked

equal to the shoot-length on the lowest level and terminating at a point distant one-half of the shoot-length below, is another estimate of r''' . As also mentioned by him, the practical application of this allowance calls for the careful study of the type of deposit as well as of adjoining mines, especially if they be deeper or near the same depth, and is admissible only if they show no cause to suspect a sudden diminution in the pay-ore.

Many will insist that mines may not be bought on a basis of the ore proved. This is often true, but in the case of undertakings calling for a heavy outlay on equipment, terms approximating these can usually be made, especially if the engineer be possessed of tact and has the intelligent support of a financial group more intent on making a good purchase than of fleecing a body of shareholders.

As before noticed, several of the leaders of the modern school have already used r''' in private advices to their clients, but whether they will endorse the following extension of

³² Mr. Hoover says that the return of 7% on a risk-rate of 10% is a fair estimate. See 'Principles of Mining,' pp. 43 to 50.

the theorem remains to be seen. This may be stated thus :

THE SOUND ESTIMATE OF THE VALUE OF A MINE ENTAILS NOT ONLY A RETURN OF THE CAPITAL AND INTEREST COMMENSURATE WITH THE RISK OF LOSS, BUT THAT THE LATTER SHOULD NUMERICALLY INCLUDE THE DIFFERENT RISKS INCIDENTAL TO EACH BLOCK COMPRISING THE ASSETS.

That this should not only be acknowledged in principle but find application in current practice on appropriate occasions is the point for which I contend.

In Table II will be found an approximate reproduction of the assets of a Mexican

for granted, so repeatedly has the ground been worked over in technical literature, hence the contention that

THE RISK-RATE FOR EACH BLOCK IS A FUNCTION OF THE DATA BEARING ON IT, VARYING INVERSELY.

is but an amplification of the old principle.

Is it necessary to lay stress on the fact that the extension of the old principle, not the formulation of a new one, is the thing aimed at? Must I hasten to add that the following scheme of allowance for risk is not put forward as an entire and perfect solution of a problem that has cost so many able men so

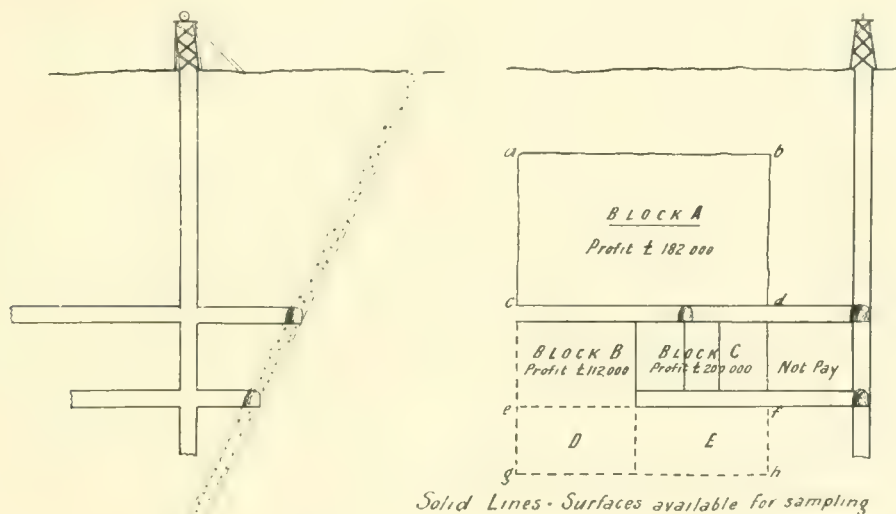


Fig. 1.

mine, illustrated diagrammatically by Fig. 1, which follows the old and unsatisfactory nomenclature of 'positive' and 'probable' classes of ore. Here will be seen a distinction without a difference: in other words, the tonnage assay-value of the 'possible' ore is given the same weight in the estimate of assets as the 'positive' or four-sided ore. Let us wrangle and vituperate one another over a distinction and then make no difference! Let one of us insist on 100,000 tons of 'positive' and 50,000 tons of 'probable' ore, and another demand the opposite proportions, yet both calmly add the values together as an asset! Great is terminology! Let us mouth meaningless words, certain that an odour of erudition, even of sanctity will follow—while yet indifferent to simple honesty.

As before mentioned, the premise that an estimate of probability is the essence of all sampling leading to block valuation is taken

much thought; or that I have not lost sight of the fact that certain internal discrepancies present themselves, though these no doubt will be remedied by those of ingenious mind when more thought is given to the subject?

A phase of the above theorem may be written:

THE RISK-RATE FOR EACH BLOCK SHOULD VARY INVERSELY WITH THE NUMBER OF SAMPLE SECTIONS AND DIRECTLY WITH THE TONNAGE THEREIN.

Applications of the above as seen in current practice will be given in the next article, but the more experienced reader will already see the necessary basis of a standard block for each mine and the kinship this will have to the distance between samples and related features.

The introduction of the high values of r''' , or the risk-rate, for which allowance must be made on the basis of the above theorem, com-

pels the careful consideration of another weighty factor in our financial equation, the principle commonly known as that of deferred annuities. While neither the deductions nor the application of the risk-rate principle have been more than touched upon, yet it is hoped that something may be pardoned in a paper dealing with elements only.

The final theorem offered may be stated as follows:

PROVIDED THE ECONOMICALLY GEOLOGICAL DATA, THE RISK-RATE PRINCIPLE ESSENTIALLY LIMITS THE SCOPE OF INVESTMENT THAT MAY BE LEGITIMATELY ASSUMED

If it be admitted that the rate to be demanded of any investment be a function of the data available, varying inversely therewith—the constants peculiar to each mine being ascertained and applied according to simple, well-established principles—the above conclusion can hardly be avoided.

Coalite.

Coalite is a coke produced at lower temperature than gas coke or metallurgical coke and is claimed to be suitable for burning in open fire-grates, giving a bright glow without draught, and without the production of any smoke. Unfortunately the company exploiting it has made a commercial failure so far, and several eminent men in the scientific and engineering world have found themselves in a false position owing to somebody's incompetence in the matters of prognostication and inaptitude for carrying out technical processes. The company commenced operations by claiming too much. It has been found by experience that the process is of no use as an adjunct to gas manufacture, so all the plants have been closed, in order to cut heavy losses, and work is now being restricted to the applicability of the fuel to domestic purposes. Herman Clarke, the new manager, publishes a report in which are given for the first time accurate figures relating to the various products. From 100 tons of coal, 72 of coalite are yielded, as compared with 65 of coke in gas manufacture, and 70 of metallurgical coke. The corresponding figures for illuminating gas are 5000 cu. ft., 11,500 cu. ft., and 10,500 cu. ft., of liquid hydrocarbons 22 gal., 9 gal., and 8 gal., and of sulphate of ammonia 16 lb., 26 lb., and 27 lb. The candle-power and thermal value of coalite gas are higher by about 30% than those of the other two gases. One of the drawbacks in connection with coalite so far is that it is so brittle that half is reduced during discharge and handling to fine

and dust which is quite unsaleable. The economics of the production of coalite require careful overhaul before further expenditure of capital. But the question of brittleness appears to be the most important point to be considered.

Mineral Development in India.

At a recent meeting of the Society of Arts, Sir Thomas H. Holland, until lately director of the Geological Survey of India, and now professor of geology in the University of Manchester, delivered a lecture on the present trend of mineral development in India. He mentioned that during the last ten years the value of the output of minerals had doubled, being £3,734,420 in 1899 and £7,499,228 in 1909. The greatest increase was in 1906 and 1907, and it happened that this sudden increase had been followed in 1909 by a slight set-back. The present tendency is once more toward a rise, but more gradual and less erratic than in the boom years above mentioned. As regards coal, practically the whole production is in the Gondwana district, and Raniganj and Jherria are the most important sections of this field, having benefited by their proximity to Calcutta. The first-named held the lead until 15 years ago, but recent railroad extensions have brought the latter forward of late years. The petroleum industry has advanced, and the production of crude oil was 233½ million gallons worth £928,658 in 1909, as compared with 37¾ million gallons worth £148,755 in 1900. Practically the whole output is refined on the spot. Hitherto most of the iron and steel used in the country has been imported, and the value of the imports has advanced during the last five years from 13 to 18 millions sterling. Many attempts have been made to smelt iron ores locally by modern methods and several of these had ended in disaster. However, another venture has recently been established for the manufacture of pig iron and steel by the Tata Company, which was floated in 1907 with a capital of £1,500,000. The works should be in operation by the end of the year. The production of manganese ores is one of the important industries of India, and the production increased from 139,265 tons in 1900 to 642,675 tons in 1909. Chrome ore and mica are also the basis of notable industries. The production of gold in India is not of the same importance as in other countries where it forms the chief incentive to immigration and general development.

IN A NICARAGUAN REVOLUTION

By R. H. B. BUTLER.

PERHAPS a few of my experiences during the recent revolution in Nicaragua will be of interest to those who read this magazine. The difficulties of mine administration, even in peaceful Spanish American countries, are well known; revolutions and martial law make it impossible. I landed in Nicaragua in September 1909, and proceeded to Granada, where it had been arranged that I should meet the manager of one of the mines in the La Libertad district, and accompany him to the mine. The revolution broke out two days after my arrival at Granada. This city is situated on the northwest shore of Lake Nicaragua, and is the headquarters of one of the two rival factions that are continually striving for supremacy. Until the close of the late war, in September 1910, the opposition party of Leon had held the reins of government for nearly 17 years. During this time the granting of large concessions and iniquitous monopolies was frequent, and the native paper currency became almost valueless. Revolutions were common, but despite all the efforts of Granada, the power of the President, J. Santos Zelaya, and his Government remained supreme.

The first sign of revolution was apparently insignificant; merely a crowd of apathetic native women sitting passively on the *cuartel* (a military police-station) steps. Subsequent enquiries elicited the information that a revolution had broken out at Bluefields, and that the women were awaiting news of the eventual destination of their men-folk, who had been suddenly pressed into military service. On the following day another symptom appeared in the form of a belated band of musicians who wailed their discordant way through the streets, accompanied by a dozen ragged natives with rifles. At every important street corner the bugler rudely interrupted the band by blowing two dismal notes, and, before these notes had died away, another individual gabbled a proclamation. The moment he had finished reading, the guard cheered shrilly, but without any enthusiasm whatever. Then the band struck up, and the procession moved on, followed by a crowd of small boys.

A few days later the plaza was filled with a rabble of soldiers, mules, anxious women, and the inevitable pigs, which infest the streets of

all the towns. Troops were hurried to the front daily, and a strong force was kept in Granada. Steamship service was discontinued on the lake, except for military purposes. Even the native schooners were forbidden to leave port, so that all chances of my reaching the mines in the district of La Libertad depended solely upon the goodwill of a suspicious government. Several days were wasted before the *jefe politico* or local magistrate could be persuaded to grant passports and permission to cross Lake Nicaragua on a troopship. Late one Sunday night, however, I boarded the small steamer in the company of the mine manager, by whose gentle persuasion the necessary permits had been obtained. Thanks to his knowledge of the native character many of the difficulties of the journey were soon overcome, and I felt very thankful for his company under such trying circumstances.

It was not for long that we had the boat to ourselves. Shrill feminine yells and the firing of rifles announced the arrival of the first detachment of troops, who continued to arrive until the small vessel was a compact mass of odorous soldiers. *Guaro* (native whiskey) circulated freely, thereby increasing the difficulties of embarkation, for when the martial brain is fuddled with drink, it is not easy to walk even a short gang-plank by the dim light of lanterns. Three or four soldiers toppled quietly and unostentatiously into the black waters, and two at least were drowned.

The iron legs of a Colt machine-gun soon usurped our little bit of deck-space. While we were wondering where to put ourselves, several soldiers took alarm and fired into the darkness. As it is a favourite plan of revolutionists to capture these steamers, we at first thought that the boat was being attacked, but after a few more shots and shrieks, the firing ceased. Not wishing to spend the whole night wedged upright between native soldiers, we attempted to go below, but so crowded were the decks and companionways that it was a slow and unpleasant process. Both of us were regarded with no friendly eye by the soldiers, who, knowing that foreigners were working the enemy's machine-guns with deadly effect, probably imagined that we were on our way to join the rebel ranks. The atmosphere below decks can be better imagined than described.

Even the tables were rimmed with soldiers or stacked with rifles. Women and boys who had been pressed into service as cooks, sat huddled together or were cheerfully sandwiched between their neighbours' rifles.

At seven the following morning the ship reached San Ubaldo, where the troops leisurely disembarked. A few soldiers assisted in the unloading of stores, but the majority of officers and men were absolutely indifferent, and therefore left this duty to the more energetic. It was a wretched rabble. The officers were dressed in cheap khaki uniforms, adorned with regulation U.S. Army buttons—to the disgust of several Americans. In the choice of side-arms each officer apparently suited his own personal taste, which generally ran to pretty nickel-plated revolvers, with pearl grips. Of the rank and file not many wore a uniform and these usually consisted of thin cotton trousers that had once been red, plus or minus an equally faded blue cotton coat. One man used a cooking-pot for a hat, whilst another was wearing a top hat of great antiquity. Long strips of raw meat were wound around the muzzles of some of the rifles, and from others projected half-smoked cigars and sundry useful articles. I saw an officer trying to put his machine-gun into working order, but as the numerous loose parts of several different kinds of guns had been carefully mixed, he found the task beyond his powers. With a hopeless sigh the loose parts were hastily put back into the wrong boxes, and the guns sent forward with the advance guard. It was not until some of the troops had begun to move that we deemed it safe to saddle our mules, which had previously been hidden away. At times like this, all beasts are commandeered for military uses, and a dead paper receipt is a poor substitute for a live mule when 40 miles of Nicaraguan road lies ahead.

Even the over-worked superlatives of American journalism are inadequate to describe the roads of Central Nicaragua. The effect of nine months of tropical rain on a soft clayey ground results in such mud as surely must be unequalled in any other part of the world. Each mule follows its predecessor, so that a number of deep troughs are formed, one pace apart, across the road. These troughs are either filled with thin mud, or thick clay, and are often several feet in depth. As a pleasant variation, there are occasional deep mud-holes into which the poor animals flounder and are sometimes lost. During the early part of the season, when the roads are drying, it becomes difficult for the mules to withdraw

their legs, and progress is correspondingly slow. The awful rain and mud, the frequent dodging of sinuous creepers, and the floundering of the wretched mules are features that make the journey a ghastly pilgrimage never to be forgotten.

Darkness was approaching as we neared the end of our day's journey, the town of Acoyapa, then strongly fortified by the Government troops. Our hopes of sleeping there that night were rudely dispelled by a passing soldier, who told us that nobody would be allowed to enter the town after 6 p.m. As the sentries are often nervous and a little inclined to shoot first and challenge afterward, we had no choice but to turn back and pass the night with a native family in a bamboo hut by the roadside. It was not at all a restful night, thanks to the attentions of the family pig, who divided his time in scratching his back on the under side of the hammocks, and pursuing an elusive empty sardine tin round the mud floor of the hut.

It is unnecessary to dwell on the next two days and our dismal journey through the mud. The road wound through thick tropical forest, steaming glades, or stagnant marshes. Suffice it to say, we eventually arrived at the mine, dripping with mud, immediately to be confronted with the problem of getting provisions. Flour and sugar were unobtainable, so that *frijoles* (beans), *tortillas* (pancake), and *dulce* (domestic sugar), were our only available delicacies for many months. As time went on it became more and more difficult to get supplies to the mine. The Government had commandeered many beasts, so that the freight-carriers, not wishing to incur further loss, declined to work. Occasionally it was possible to get a special guarantee for freight-carrier and beasts, and in this way deliver a few supplies, but these guarantees were so often dishonoured, the mules and men being taken by the Government, that the freight-carriers could not be blamed for refusing to take further risks.

For nearly three months it was possible to keep the mine and mill working with a reduced staff, and to stave off the numerous "recruiting parties" that swooped down, carrying off man and beast. Many native workmen remained hidden in the bush, the others came to work with small sacks containing the necessities for the simple life, holding themselves in readiness to go into hiding.

In due time the blow fell. The *commandante* arrived one afternoon and after informing us that all guarantees were rescinded, de-

parted with every man who had failed to be absorbed in the landscape. Constant rumours of Government victories were circulated, but were always followed by a small persistent whisper that the revolutionists were a little nearer. The *commandante* grew worried and anxious. Generally this official takes it upon himself to get into a safe place as soon as the

Daylight revived the drooping courage of the refugees, who returned to their homes in the village. Late the same afternoon a spluttering rifle fire was heard in that direction. After the firing had ceased we waited anxiously, and, as there were no fugitives, started to go to the village. Before arriving there we observed long files of armed men converging to-



enemy approaches, or if taken by surprise, hides under his bed. It was not long before the *commandante* was conspicuous by his absence, and two days after his departure the enemy were said to be approaching the village. Panic spread at once, and long lines of dejected women wound their way down the trails to the *hacienda* (house). By nightfall about 60 women and children were claiming protection. The office, outhouses, and verandahs were filled with frightened women, dirty babies, and pet parrots.

ward our destination, while above us, in the bushes on either side, revolutionary riflemen were watching us with evident curiosity and doubt. From the end of the village more men trickled out and wound in snake-like lines to the high ground in front. In the streets were little knots of terrified women, many of whom beseeched us to allow them to return with us through the troops, passing themselves off as the *hacienda* cooks. Over a dozen followed behind on our return, with their babies and parrots, to the intense amusement of the out-

posts. Fugitives continued to arrive at the *hacienda* until after dark. Among these was an ex-official of the Government, who would have been considered a fat prize by the invaders. This individual requested permission to hide under a bed, as his enemies were many. It was one of our few amusements in those dreary days to open the door suddenly and watch him dive under the bed. As we were frequently visited later by revolutionary officers, he became quite an expert in the art of dry diving, and was probably the only man in the house who got any real excitement out of life. Unfortunately, however, he observed from his window that the blacksmith's shop was being used for repairing rebel rifles, and that dynamite, electric firers, and precious provisions were being sent to the enemy's camp. Later, when we again fell into Government hands, this man proved his gratitude by reporting our revolutionary tendencies.

It is extremely difficult for any foreigner to remain neutral during these disturbances. Both sides expect sundry gifts of dynamite, supplies, or other favours. Any refusal to accede to these requests is taken as direct evidence of sympathy with the other side. To keep things running without the goodwill of the authorities is impossible. Even such a trifle as the wearing of a green tie (the rebel colours) has been sufficient to rouse the *commandante's* ire and distrust. By pressing the native workmen into service he can make all work impossible, and his refusal to grant passports prevents any possibility of moving from place to place without risk of arrest and imprisonment.

The Commander-in-Chief of the revolutionary army visited the mine, and was much impressed with the utility of the 'transit' or theodolite as a range-finder. We were asked to show our ability in this direction should it prove necessary. This might have been an interesting diversion. Later, an American officer in charge of the artillery offered me a vacancy on a machine-gun crew, a tempting proposal that had to be refused.

During these days we deemed it wiser to sleep in our clothes, as a large Government force was at La Libertad, only 12 miles distant, and a battle was expected at any moment. Our sense of security was in no way increased by our knowledge of the fact that the dynamite and detonators were stored in the house, and would be in the direct line of fire should there a fight. It is apparently the custom in this district to store dynamite, detonators, and steel in the tool-room. The reason for doing

this appears to be a simple one: If the house is blown up, the tools will not be needed.

Most of our refugees summoned up enough courage to return to their homes after a few days, with the exception of the gentleman who was still playing hide-and-seek under the bed. The rebels neither burnt the town nor killed the inhabitants, but were orderly and well-behaved, paying for nearly all that they took.

After a week's occupation of the village, the rebels announced their intention of marching to attack Libertad. The troops fell in, but instead of taking the road to Libertad, struck off into the mountains. This was the signal for another influx of women and children, as it was believed that the rebels were retreating, and the people dreaded the vengeance of the Government troops. For three days there was no news, and time hung heavily on our hands. The mines and mills remained closed down, and food was scarce. Even the eternal *frijoles* and rice were almost unobtainable. With no books, no mail service, and no occupation save that of guarding our belongings, life was indeed a dull affair. Black clusters of watchful buzzards, rain-sodden and hungry, always hung around, and only added another harmonizing detail to the scene. The village was empty, except for the sick men who had been left behind, plus the usual somnolent pigs and emaciated dogs. There was ample time for reflection and to come to the conclusion that personal energy and effort were alike useless.

The Government troops at Libertad waited a few days, until their enemies had got clear away, and then bravely attacked the empty town, returning triumphant to Libertad with the invalid rebels as prisoners. This affair was reported as a "great victory" for the Government. Our one refugee now emerged from his abode under the bed and became valiant, immediately proceeding to make things unpleasant for the families of those who had joined the revolution. The native miners remained hidden in the bush, refusing to work until Government guarantees of exemption from military service were provided. The local *commandantes* refused to grant these, necessitating a special journey to the Government headquarters in Acopapa, where these guarantees were eventually obtained.

Deeply suspicious, a few natives emerged from the bush, consenting to test the genuineness of the guarantees. Mine and mill again commenced to work. For a few days all went well. Then the *commandante* descended, and after informing us that all guarantees were

again rescinded, went off in charge of our dejected *mozos*. Obviously if work was to be done, guarantees must be obtained from the Minister of War himself, and it became my duty to ride to Granada to try and get them. It was no easy task to get a passport, for the authorities were suspicious of everyone, especially foreigners, from the disaffected zone.

Space forbids my describing an interesting journey through the bush, and around the north-eastern shore of Lake Nicaragua. Everywhere along the road, troops were watching intently for the vanished rebel army. Almost at the very gates of Granada I had a narrow escape of being stopped, but, by preserving a wooden

tors carefully sent their worldly belongings to the hotel, preparatory to flight. The sentry in the street, outside my bedroom door, made a whispered request to be allowed to hide under my bed if necessary. "Recruiting parties" scoured the streets, and searched the houses. Even boys of fourteen were dragged off to fight. One party searched the hotel, took the waiters, native guests, and were preparing to take me also, until a hurried explanation put matters right. Under cover of darkness the wounded were hurried quietly down the back streets, while in the main thoroughfares the bands played and the shrill-voiced rabble marched gaily to the front. Rumour after



A Revolutionary Outpost.



Santo Domingo.

countenance and a cheerful inability to speak Spanish, I managed to continue my journey.

My arrival in Granada was timely. On the same night the rebels threatened the road, troops were rushed out, and no one was allowed to enter or leave the city. Despite all precautions, however, numbers escaped by night and joined the rebels. Sandbag barricades were hurriedly thrown up in the streets, machine-guns placed at the corners of the plaza, and no one was allowed out after dark. Intense subdued excitement prevailed. The hoarse challenge of the sentries in the streets disturbed the night, while in the daytime little knots of excited men talked in whispers, for fear of the paternal Government. Nor were other signs of apprehension lacking. The telegraph opera-

rumour circulated, was denied, and circulated again. Finally came authentic news of a Government victory, followed by tales of utter annihilation of the rebel forces. Guns banged away in the plaza, and rockets soared and burst overhead. The populace were ordered to celebrate, as a great victory had been won by the Government. Several days later the whole truth leaked out. The rebel army had been outnumbered by three to one, and after inflicting such severe losses upon their adversaries as to prevent them from following, they had retired, leaving several guns behind.

The revolutionists now fortified themselves at Rama and Bluefields, and no attempt was made to attack them. It was the common belief that the war was now over. The roads

were reported as being safe, so that after the usual delay in getting passports, I started for the mine with the necessary guarantees from the Minister of War, granting exemption from military service for a limited number of men.

Upon arriving four days later, my expectations of finding a tranquil neighbourhood were rudely disturbed. Libertad had declared for the revolution a few days previously, and, after capturing all available arms, this contingent had departed for Rama. As a punishment, a large Government force was sent to Libertad, under the command of a fractious *commandante*, who refused all passports and requests whenever he felt so disposed. Mules were being eagerly sought after and commandeered by the troops, and it was almost necessary to sleep with a protecting arm round the neck of a mule to prevent his being stolen.

Another period of spasmodic working now began at the mine, with the usual trouble with the *commandante*, who once so far forgot himself as to place a file of soldiers in the road with orders to shoot if we attempted to go to the mine. On another occasion a nervous company fired two volleys at our survey-party, mistaking the transit for a Colt machine-gun. Two of the native miners were arrested and threatened with a flogging unless they would repeat certain disloyal statements said to have been made by foreigners in the *hacienda*. Our only bricklayer, who was building the assay-furnace, was taken away as an ex-revolutionist, and shot.

For nearly three months some sort of tranquillity reigned, during which time it was possible to keep a small force at work. An irregular mail service began, although most of the letters had been opened, read, and re-sealed by the authorities. A little freight-carrying was done, but the supplies that reached the mine were few and far between. Early in June the revolutionary army advanced from Rama, close on the heels of the retreating Government forces. Recruiting began again, and the workmen vanished into the bush. Libertad was captured by the rebels, and the Government troops were besieged in Acoyapa, offering determined resistance, eventually fighting their way to San Ubaldo, a strongly fortified post on Lake Nicaragua. At this place was a large accumulation of merchandise and mining supplies, and much anxiety was felt by the merchants and mine-owners for their property. Although practically impregnable, San Ubaldo was hurriedly abandoned after a short skirmish. Anxious merchants and mine owners immediately hurried to the scene only to find

that every case and crate had been broken open and all provisions taken. Circular filter-cloths had been conveniently transformed into tents, and were riddled with bullet-holes in consequence.

Events now followed each other in quick succession. José Madriz, the new President after arranging terms of surrender, promptly decamped, with much booty in the shape of money and valuables. All letters in the Post Office were opened, and what was not wanted left scattered on the floor. Peace was then officially declared, but in spite of this, a force of 600 of Madriz's soldiers, who had shut themselves up in a church in Granada, refused to surrender. Being well stocked with food and water, armed with machine-guns, rifles, and abundant ammunition, and commanding a view of the whole town, it was impossible to dislodge them with the limited forces that were then available. Anyone who showed himself in the street was promptly shot. The wounded had to die in the sun or wait until dark to crawl away, and anyone who attempted to give succour was greeted with a hail of bullets. Even pack-oxen were shot down, and the buzzards feasted in the streets. All houses in the vicinity of the church were riddled with bullets from rifles and machine-guns. Many women and children were ruthlessly shot down, the total list of casualties being about 60. It was nearly two weeks before the besieged would discuss terms of surrender. Eventually it was agreed that they should be allowed to march down to their town of Leon, and there surrender. Refusal to believe that Madriz had deserted them, had, they said, made them hold out; but this in no way excuses the deliberate shooting of women and children.

Now that the war is presumably over it remains to be seen whether the new Government will keep its promises and good resolutions. Freedom of speech and inviolability of the mails has been guaranteed, and the abolition of all concessions and monopolies is also promised. For 17 years concessions and monopolies have flourished under the iniquitous régime of Zelaya, which has done much to hinder mining and the natural development of a rich country.

Those who know the native character are liable to regard a new Government as the same breed of dog, but with a different collar. Certain it is that there can be no great influx of foreign capital until stable and honest government is assured. The turbulence of these petty Central American republics cannot much longer be allowed to menace industry.



GUATEMALA SOLDIERS.



UPPER TRAIN.

GOLD DEPOSITS OF COTHY, SOUTH WALES

By BERNARD W. HOLMAN.

IN the first Memoir there is a copy of an old map of Britain made by the elder Pliny apparently intended to accompany a treatise on Roman mining in Britain, similar to his account of Roman mining in Spain. This map shows only one spot marked 'Aurum,' at a place about midway between Llandilo and Lampeter in Carmarthenshire. The place is called Pumpsaint, in memory, it is said, of five saints who went into the mines in the days of St. David and were never seen again. I was at these mines for three years, 1907 to 1910, and some notes of my investigations may be of interest.

In recent times attention was first drawn to the district by Sir Warington Smyth, in the Memoirs of the Geological Survey. About the same time, three Australians who investigated the old workings put up five stamps run by a water-wheel, and for several years earned sufficient to support themselves by crushing the quartz and extracting the free gold from the outcrops of various leaders. These quartz leaders are as much as 4 ft. wide, but seldom carry more than $2\frac{1}{2}$ dwt. in free gold. More recently rolls and jigs were installed and a little work carried out on the pyritic slate bands found in the cuttings and caves. A concentrate of arsenical pyrite was obtained, varying from $1\frac{1}{2}$ to 6 oz. gold per ton. The local treatment of this product needed too much capital, and no smelter could be found to pay a good price for both the gold and the arsenic. After some attempts to treat the concentrate by direct amalgamation the project was abandoned in 1900.

It is only during the last five years that a systematic study of the deposits has been made. The company doing this work has the lease of 300 acres along the line of the Roman workings and also the underground rights for 5000 acres on the dip. The old workings consist of five open-cuts at intervals for a mile along the side of a continuous ridge of hills running northeast. The hypothesis that the workings are of Roman origin is supported by Professor Haverfield of Oxford and by Professor Bosanquet of Liverpool who personally examined the workings last year. On the other hand Dr. MacIver, who is known in connection with the archeology of the Zimbabwe mines in Rhodesia, contends that the workings date from the Stuart

period, that is about 1600, but I consider that the size and character of the old workings and the extent to which they are overgrown negative this view. For instance, an old oak tree of over 30 in. diameter blocks the entrance to an adit although the tree has to grow on what was once a dump.

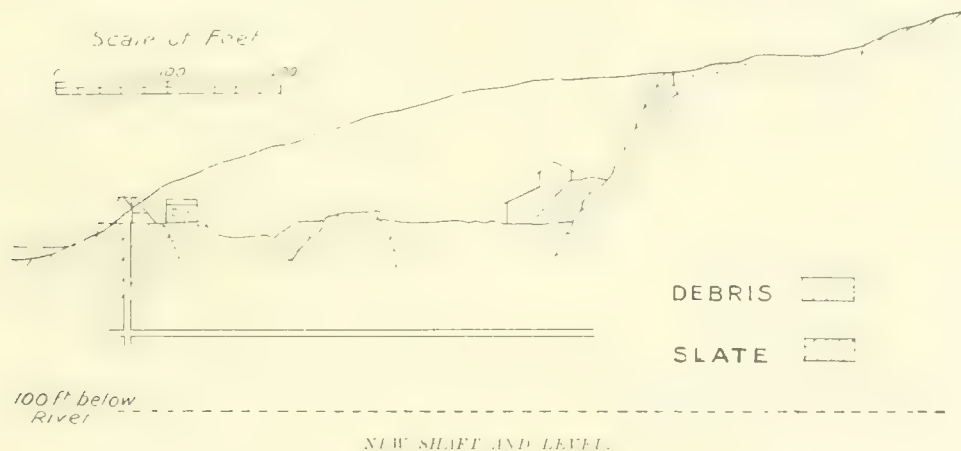
Besides the quarries there are many caves, or wide stopes, mostly filled with debris, and one or two adits. The uppermost adit, at Penlanwyn, is 60 to 70 yards long and about 7 ft. square with vertical sides and flat roof. It was probably driven during the last days of the Roman occupation, for the pieces of slate on the dump outside show numerous chisel-marks. This adit and the one below it communicate with a series of caves far into the hillside, and below, and on the dip of, a deep cutting on top of the hill. The waste stuff filling the caves to within a few feet of the roof, and the arrangement of the levels, seems to indicate that the Romans did some sorting below ground, and understood the principle of using the waste for standing as they stoped the roof. The method indicated was probably the best the ancients could have chosen, as the quartz and the softer mineralized slate forming the lode-stuff varies from 6 to over 20 ft. in width, while the walls are fairly firm. The roof is supported in some places by pillars and walls built of uncemented stones, mostly flat pieces of slate. The indications are that the Romans worked only for free gold. Hence quite apart from the water difficulty, it is improbable that the mine has been worked for any depth below the adit.

That oxidation of pyritic matter has taken place is indicated by the occurrence of honeycombed quartz above the level of the valley and of mineralized bands in the slate completely oxidized to a soft white clay and carrying only free gold. This honeycombed quartz is usually stained yellow to brown and sometimes the cavities contain portions of pyrite crystals, and even plain iron oxide, and occasionally specks of gold. Some of the quartz, with similar cavities, is stained green or yellow, indicating that mispickel also occurred at one time near the surface, but, like the iron, has been oxidized and leached above the level of the valley.

Unfortunately the main vein of the formation striking northeast has been almost com-

pletely exhausted above adit by the ancients, hence we do not know for certain what kind of stuff they worked, but the general arrangement of the dump, the coarse crushed stuff, and the slime, indicate the mining and careful sorting of much quartz; moreover, the fact that much of their dump gives a show in the pan (a general sample assayed 2 dwt. 17 gr.) indicated that they worked a partly unoxidized ore. The occurrence of over $2\frac{1}{2}$ dwt. in the tailing left by people who could make a profit from 1 dwt. ore in the Carpathian mountains shows that the gold left must have been in a condition where it was not recognized or amenable to their treatment. It was presumably arsenical pyrite; if so, we should expect the gold to be free after standing in the open for over 1700 years.

arsenic; the concentrate assayed 4 oz. 12 dwt. gold and 5% arsenic, the middling 1 oz. 13 dwt. gold and 14.8% arsenic, and the tailing 4 dwt. gold. That from the 'Arsenical' vein (24 in. wide) assayed 11 dwt. 14 gr. gold and 9% arsenic; the concentrate assayed 4 oz. 14 dwt. gold and 27% arsenic, the middling 1 oz. 10 dwt. gold and 17.8% arsenic, and the tailing $3\frac{1}{4}$ dwt. gold. The trial crushings treated 70 tons of ore taken from the seven different veins and bands left above the adit by the Romans, assaying from 5 dwt. 5 gr. to 11 dwt. 11 gr. at the screens, the veins varying from 2 to 10 ft. in width. The average from all the veins was 8 dwt. 4 gr. at the screens, equal to 32s. 8d. per ton. The gold obtained by amalgamation and concentration equalled 19s., and the gold left in the tailing, recoverable by cyanide,



The workings, up to the present ownership, were all above the adit-level and were, therefore, off the main line of the formation. A good deal was done southward in 1890 and three or four mineralized quartz veins were opened. They varied from 24 to 48 in. in width and 12 to 6 dwt. in value. These veins were thoroughly examined in 1909 and were found to be distinguished from those of the main formation by their narrow widths, their structure (solid quartz, not intermingled with slate) and their steep dip (60° to 70°). Their strike is almost at right angles to the run of the slate instead of roughly parallel to it, as were the orebodies in the Roman workings.

Trial crushings in 1909 with 5 stamps of 750 lb., with concentration over a Wilfley table, from two of these veins gave the following results: The ore from the 'First Pyrite' vein (30 in. wide) contained 10 dwt. gold and 1.5%

equalled 12s. per ton. The cost of mining and treatment is estimated at 12s. per ton. The work done and observations made in opening up and sampling these veins proved the gold to occur in a manner new to Great Britain and entirely different from that of St. David's in North Wales, 60 miles distant.

The fact that the Roman workings are of great width (80 ft. and more) and show an alignment northeast for about a mile, that has no apparent connection with the strike of the quartz veins just mentioned, and the fact that this alignment is roughly parallel to the strike of the slate, led the owners of the property for the first time to look to the slate itself, rather than the quartz, as a source of gold ore. The first fruit of this unusual course of action was the discovery that the whole of this strip or belt of country, for a width of nearly 400 ft. is characterized by the

occurrence of independent bands of mineralized slate varying from 3 up to, in one case, 40 ft. in thickness, all running with or slightly across the slate of the country, and individually of constant value, the gold content in each case being proportional to the amount of pyrite. The pyrite concentrate averages about 25 dwt., and the arsenic may vary from $1\frac{1}{2}$ to 20%, hence slate showing 20% of sulphide, with probably no free gold in the pan, will run 5 dwt. This gold is easily shown by panning if the sulphide is separated and roasted in the muffle or on the forge, and then re-panned. The mineral in these bands consists of iron pyrite and mispickel, and varies, in different bands, from 1 or 2% showing only as shining specks across the cleavage of a piece of freshly broken slate, to over 90%, when all trace of the original cleavage is destroyed and the band appears as solid fine-grained dark pyrite. Some of these bands are completely oxidized to a soft white clay, with the gold free-milling and sometimes nuggety, while the majority are unoxidized even near the surface and contain practically no free gold. It has been suggested that this extreme difference is due to the original occurrence of the iron sulphide in the form of marcasite in the oxidized bands. Some of these bands would be profitable to mine because, although usually running only from 5 to 7 dwt. gold, their width of 7 to 12 ft. and great evenness of grade, together with the comparative softness of the mineralized material, would all tend to meet the expense of treating the combined gold and would perhaps altogether afford a more valuable and, what is almost as important, a far more reliable source of profit than the quartzitic zones of enrichment worked by the Romans.

One such band, on the south side (foot-wall) of the main run, was investigated in 1909, and is exposed near the surface in the side and end of a cutting some 20 ft. deep, and again in an adit some 40 ft. below the bottom of the cutting. The band averages 7 ft. in width and is traversed by stringers of quartz showing free gold. At the actual trial crushing it gave a screen-assay of 6 dwt. 12 gr. gold, and $1\frac{1}{2}$ % arsenic, and a tailing running 3 dwt. Approximately 9% of concentrate was obtained which assayed 1 oz. 12 dwt. 14 gr. gold, and 6.7% arsenic.

The belt of mineralization in which these bands occur is not shown by the Geological Survey, nor is the considerable fault which traverses the formation, and which is probably the primary source of mineralization. The official map of the district is coloured a uniform

pink indicating that the country is of Lower Silurian age, a statement supported by the fact that the only fossils found are pyritic casts of *graptolites* nearly always oxidized to mere straight or forked brown stains in the slate. The more perfect casts only show the simpler forms of *monograptus* and *didymograptus*, and have not been investigated. Even these simple fossils are difficult to find owing to the manner in which the slate is faulted and bent.

In the course of the investigation by the present owners it was also noticed that where individual quartz veins of low value, running across the belt, intersected the mineralized slate bands, considerable enrichment took place and much coarse gold occurred. The quarries in the hillside cut right across the belt and their dumps show them to have cut across where there was much quartz; therefore, it was deduced that similar enrichments, but on a much larger scale, existed at these places, and that the Romans were fully aware of the mode and cause of enrichment, as well as where to look for most free gold. Following these deductions to their logical conclusion, Mr. James Mitchell, lately of the Rand and Kimberley, advised, jointly with Mr. H. T. Burls, the sinking of a shaft in the slate clear of the hanging wall of the east and west formation, and to the north of the largest quarry, and the driving of a cross-cut beneath the floor of the quarry, right across the width of the main belt of mineralization. At least, the wide mineralized bands traceable as persistent for 200 ft. vertical by caves and quarries, and proved to be of constant value, would be cut, while possibly a zone of quartz-slate enrichment and free-milling gold equal in thickness to the length of the quarry would be traversed, and other similar zones found beneath the smaller quarries, the intervening country containing only the bands. Thus, in either case, a highly profitable formation would be penetrated.

The position of the main shaft at the foot of the big quarry, on the floor of which are the mill offices, smithy, etc., is shown in the accompanying section, on a scale of 160 ft. to the inch. The top of the shaft is 63 ft. above the river; the south cross-cut from the present bottom of the shaft is 33 ft. below the river, and 96 ft. below the floor of the quarry. The quarry is 200 ft. broad and over 350 ft. long, and the vertical height of the east wall and south end is 80 ft., plus the depth of the debris, which in most places is over 30 ft. On the west side the hill rises steeply, but has been

much cut away. The second shaft is being sunk about a quarter of a mile to the west at a point on the outcrop, some 150 ft. above the level of the top of No. 1 shaft, and will be most interesting historically, as it will cut through the successive levels of old caves entered by the adits mentioned (Penlanwyn) and by others lower down the hillside, indicated by dump-heaps, but blocked by falls long ago.

No. 1 shaft was sunk 96 ft., timbered, and equipped in 1909. The south cross-cut from

neath the debris on the floor of the quarry and hence was overlooked. Its hanging wall and foot-wall are well marked, the former by a useful layer of from 3 to 6 in. of soft dark clay, and the latter by a leader of laminated quartz and pyrite 4 in. in average thickness and assaying 10 dwt. A report issued in November 1909, describes the vein as consisting of 4 ft. of solid quartz containing iron and arsenical pyrite with a little galena, carrying coarse and fine gold. The average assay value across 4 ft. is given as 11 dwt. 4 gr., and



Modern Mill on Roman Open Pit.



Roman Cave showing Fault in Slate.

this shaft will be the first to prove the promised land, and in February last had been driven 80 ft. with encouraging results. It has over 300 ft. more to go before cutting across the full width of the mineralization indicated by the quarry.

In sinking No. 1 shaft an unexpected vein was cut at 83 ft. This vein seemingly forms the extreme northern boundary of the zone. Its strike is roughly parallel to that of the country slate, but its dip is much flatter, about 40°, while that of the slate varies from 50° to 65°. Owing to its low dip the outcrop is be-

neath the assay of a general sample of the dump raised in sinking through the vein as 10 dwt. 10 gr. Below this solid quartz was a foot of slate, with cleavage parallel to the dip of the vein, carrying leaders and bounded on the foot-wall by the laminated leader just mentioned.

Subsequently a cross-cut was driven due

with the vein, but in the latter and the vein again intersected. Levels were started east and west in the vein and had each progressed about 25 ft. by February last. The width, 6 ft., for this 50 ft. was nearly uniform and so were the assay-inches, although the width of the quartz varied much. In one place the quartz filled nearly the whole width from clay hanging wall to foot-wall leader, while in another it filled but six inches. This narrow width plus the slate (5 ft. between it and the foot-wall leaders) together actually assayed slightly more than the solid quartz section, the slate being highly mineralized.

Mr. J. S. MacArthur sampled and reported on the mine early in 1910, and in his report states the existence of other veins. Besides the one just mentioned, the most important, about 8 to 10 ft. wide, assayed in duplicate across the whole width 1'63 oz. and 2'37 oz. of gold per ton. This is a characteristic mineralized pyritic band and occurs in the hanging wall of the main run of the formation some 40 ft. south of the vein intersected in the shaft. Where cut, it consists of nearly solid pyrite (the cleavage of the slate being entirely destroyed) and is in contact with quartz. Thus it is the first example of the enrichment expected to be found beneath the floor of the quarry. Mr. MacArthur further says that the numerous small veins and stringers shown in the cross-cut are so rich and so numerous that they almost make the whole length of the cross-cut profitable. In conclusion he says: "The whole visit and the results obtained from the samples taken by myself have been a pleasure and a surprise." Shortly after this visit in February 1910, water was struck, and the two sinking pumps installed were unable to keep it under. The capital being exhausted, work had to be suspended, and the company is waiting for further funds.

What is a Mineral?—During the last eighteen months we have mentioned several lawsuits undertaken to determine what is a mineral according to the meaning of the Railway Consolidation Act. A mineral is held to be any constituent of the earth's crust that has a special value. China-clay has been adjudged to come within this category, but on the other hand stone suitable for ordinary building purposes has not. The most recent case relates to fireclay, and the House of Lords has decided that this substance is undoubtedly a mineral within the meaning of the Act, being of notable value and the basis of a special industry.

Sub-Inspectors for English Mines.

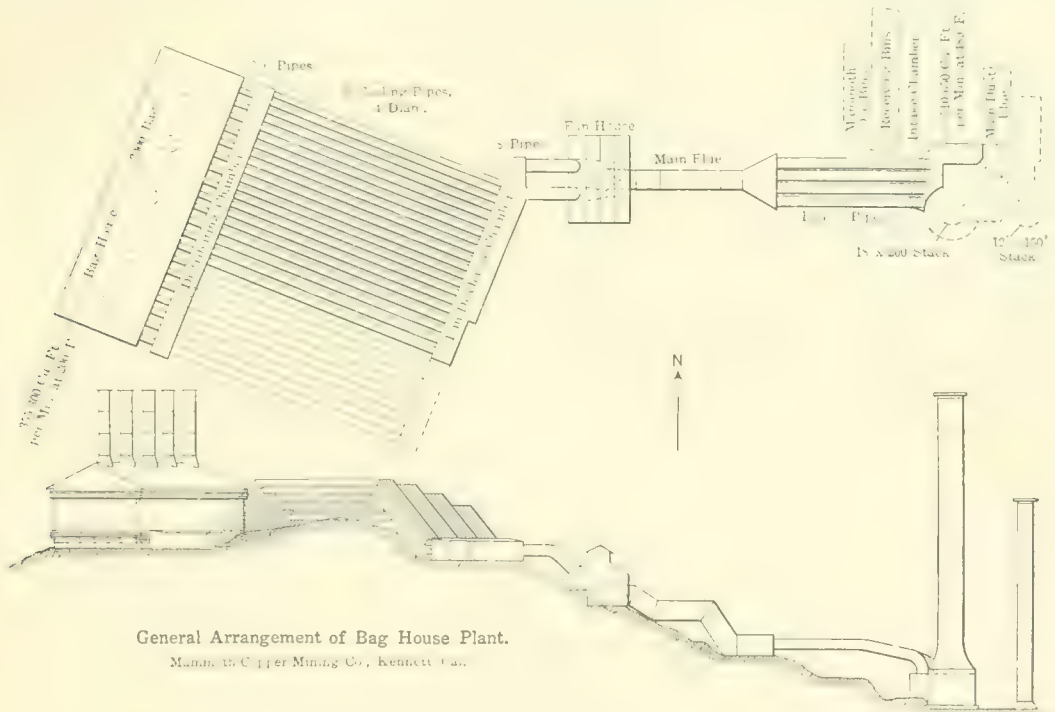
For some years the miners in Great Britain have been asking for the appointment of inspectors drawn from their own ranks. There were two arguments for this demand. In the first place the present Government Inspectors of Mines are high officials and as such are suspected of being invariably in sympathy with the employers and owners; and, second, these high officials are not sufficiently in touch with the mechanical details of operation, which appear small to them but which may be of immense importance from the point of view of the safety of the worker. More often than not the serious accident is caused by some apparently trivial matter. The Home Secretary has now decided to appoint thirty sub-inspectors drawn from men who have had five years continuous underground experience; two will be allotted to each of the six Mining Districts, with an extra one for Yorkshire, and two will devote their attention to quarries. Circulars have been issued inviting applications. The applicants will first have their general qualifications investigated by a committee of the Home Office, and those selected will be subjected to competitive examinations, one being held in each District, thus ensuring that the men shall have thorough knowledge of local conditions. Candidates are expressly warned that political or social influence must not be invoked; to hand in an endorsement from a Member of Parliament would be fatal. The subjects covered in the examination will be such as will prove the candidate's knowledge of ordinary routine practice and his ability to write an intelligible report. The salary is to be £150 per year, rising £5 yearly to £200. The scheme has not been sufficiently elaborated for it to be possible for the Home Office to give an outline of the duties of the new inspectors; but the main idea is clear enough, or applications would not be invited.

The mine owners and their friends are inclined to be sarcastically sceptical as to the value of the services of these working-men inspectors, and they call the formation of this new class of official a sop to the Labour party. They allege that a competent pit-man will not find the post attractive, for he can earn as much in four days, and the absence of any limit to his hours of labour and responsibility will form a decidedly unpleasant feature of his new work. But surely among the hundreds of thousands of workers fifteen honourable, capable, and ambitious men can be found, to whom the work will be congenial.

PRÉCIS OF TECHNOLOGY

Smelter Gases and Fume.—Two articles on new plants at copper smelting establishments in Shasta County, California, the object being to remove sulphuric acid and fume from smelter gases, have recently been published. One by Claude T. Rice appeared in the *Engineering and Mining Journal* for March 25 and described the baghouse plant at the Mammoth Company's smelter at Kennett. This plant was put in operation in July 1910. The ore smelted at Kennett is chiefly pyritic ore from the company's own mine, and in addition about 15% of silicious ore is bought in order to make full use of the excess of iron. The smelter contains five blast-furnaces, together with converters. Owing to the high percentage of sulphur

or lime, was described in our issues of December 1909 and April 1910. At present air is admitted before the fans in order to partly cool the gases, but it is found that the efficiency of the cooling pipes is thus impaired, and that it is best to have the highest possible difference in temperature between the gases in the pipes and the outside air. The California law fixes a maximum on the amount of sulphurous acid, as well as of the sulphuric acid, contained in the effluent from the stack, so it is necessary to dilute the gases somewhere. In future it is to be done after the gases emerge from the baghouse. As regards the extraction of the solid particles, most of the flue dust has settled in the old brick flues before the gases come to the new plant, and very little of the finer fume settles on its way through the latter owing to the high speed of the



in the charge only a small quantity of coke is used. During last summer it was not possible to run more than two blast-furnaces, as the cooling apparatus in the baghouse department was not equal to a greater capacity. During the winter it has been possible to run three furnaces. The gases from the furnaces and converters go through the old brick flues, past the old stack, and then through four pipes 8 ft. diam. to a steel collecting chamber 42 ft. wide in front and 15 ft. high. The width of this chamber is less at the back, as shown in the illustration. From here it goes up the main flue and through the fan-house, thence to 38 cooling pipes, 4 in. diam., and subsequently to the baghouse. It happens that the ore contains 4 or 5% of zinc, and the oxide of zinc volatilized in the blast furnaces has the effect of neutralizing any sulphur trioxide present in the gases from the blast-furnaces, but as some may come from the converters, the Sprague method of neutralizing it is adopted at a point where the gases issue from the fan-house. This method, depending on the introduction of zinc oxide

gases. The fume is practically all caught in the baghouse. By the cooling of the gases the life of the bags is greatly prolonged. Mr. Rice also gives an account in considerable detail of the baghouse and of the smelting plant generally.

In *Mining Science* for March 30, A. H. Martin describes the Balaklala copper smelting plant at Coram, Shasta County, California, and incidentally gives some information relating to the improved form of Cottrell electrostatic fume-settler recently erected there. The smelter contains three blast furnaces for coarse ore, one reverberatory for fine ore, McDougal roasters, and converters. The gases from all these are sent through the Cottrell plant before going to the chimney. This plant consists of a series of nine steel chambers each 30 ft. long, 10 ft. wide, and 10 ft. deep. In these are suspended alternate rows of steel strips 6 in. wide and of strips of micanite, that is built-up mica, made with serrated edges. There are 600 of each set of strips in each chamber. The steel strips are the positive electrodes and the micanite

made of steel as well as the positive electrodes, and it was at the end of December 1910 that the mica was adopted, the additional points thereby being gained making the removal by jarring more efficient. It is stated that 85% of the offensive content of the gases is removed, and that the extraction is being gradually improved. The author does not say how much power is required for producing the electricity, the reason probably being that the question has not yet been fully ascertained, nor does he enter into a discussion as to the relative amount of fuming caused by this discharge. It would be interesting to know how much fume is caught when no current is used, and what proportion the attainment is increased by the use of the electrostatic discharge. The first cost of the plant is not great.

Flow of Heat through Furnace Walls. *Bulletin No. 8* of the United States Bureau of Mines contains some important information relating to air-spaces in furnace walls. It has been hitherto supposed that, as air is a bad conductor of heat, it was good policy to build the brick walls of a furnace with an interstitial air space. For other reasons such a structure is often adopted, for instance to give the walls more play for shrinkage or expansion and so obviating the serious cracks that would occur if the walls were solid. The fallacy of the theory of the air-space as a non-conductor was discovered by Walter T. Ray and Henry Kreisinger, the authors of this *Bulletin*, during experiments at the Government fuel-testing station at Pittsburgh. The *Bulletin* contains a record of the methods adopted for ascertaining the rate of flow of heat through the walls. The conclusion of the authors, which is surprising and unexpected, is that, so far as loss of heat is concerned, a solid wall of brick or any ordinary material is preferable to a hollow wall of the same total thickness, especially if the air-space in the hollow wall is near the furnace side. There is a general belief that since air is a poor conductor of heat, air-spaces built into the walls of a furnace will prevent or reduce heat dissipation through the walls. Although there may be instances of furnace walls in which such construction reduces the rate of heat-flow through them, yet as a rule the effect of the air-space is just the opposite. While the heat travels very slowly through the air by conduction, it leaps over the air space readily by radiation. Although this latter mode of heat propagation is common in nature, the laws governing it are not generally known and are seldom taken into consideration when furnace walls are being designed.

The quantity of heat passing through a portion of a solid wall by conduction depends on the difference between the temperatures of the two planes limiting the portion of the wall. The quantity of heat that passes across the air-space in the wall depends on the difference of the fourth powers of the absolute temperatures of the surfaces enclosing the air-space. It follows that, in case the heat passes by conduction through the solid portion of the wall, the loss remains approximately the same so long as the temperature of the two limiting planes remains constant, no matter what may be the temperature of the two planes. On the other hand, the heat passing across the air-space by radiation increases rapidly with the temperatures of the enclosing surfaces, although the difference between these temperatures may remain constant. The important point is that the air-space, which is advantageous in the walls of a refrigerator because the tem-

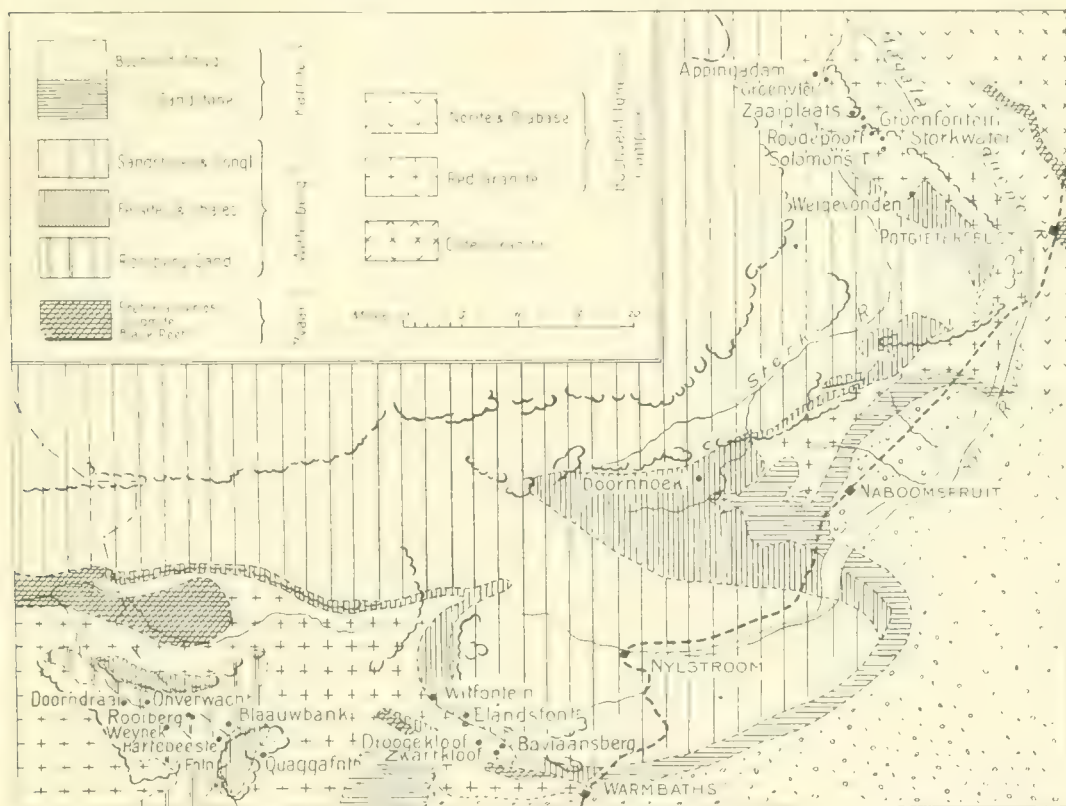
peratures are low, is objectionable in a furnace wall because the temperatures are high.

It is customary to put air spaces in furnace walls between the fire-brick linings and the common brick. Usually the fire-brick lining is only half-a-brick thick, which construction brings the air-space too close to the furnace. The result is that the temperatures of the surface enclosing the air-spaces are too high, and in consequence too much heat is radiated across the spaces. The heat passing through such walls would be much reduced if the air-spaces were filled with loose brick, or, better, with some cheap non-conducting material, such as ash, sand, mineral wool, etc. Even where the fire-brick lining is one brick thick (9 inches), the temperature in the furnace may be high enough to raise the temperature of the air-space surfaces so much that the heat radiated across the space will amount to more than would the heat conducted through a filling, were the filling only common brick.

Transvaal Tin Deposits.—The production of tin in the Transvaal is rapidly becoming an important industry, so that the review of the geology of the tin district north of Pretoria appearing in the *South African Mining Journal* for March 18 is of timely interest. The first official record of tin production in the Transvaal was that for the statistical year 1905-6, during which time the value of the output was estimated at £4474. Up to the end of 1910 the Mines Department reports a production valued at £691,350, and the present monthly output is worth about £30,000. To give an idea of the importance of the mines, we may mention that the Zaaipplaats mine is producing more than Dolcoath. Another interesting feature is that the tin is mined from veins, and that practically no alluvial deposits have been found. At the present time there are four producing mines, Zaaipplaats, Groenfontein, Doornhoek, and Rooiberg, each of which has 10 stamps in operation. As recorded in our *Précis* last month, the last-named is about to erect a new mill containing 20 stamps. Other properties that promise to contribute to the output shortly are the Groenvlei, Appingendam, Leeuwpoort, Vellefontein, and Rhenosterhoekspuit. The accompanying map shows the geology of the Waterberg district where these deposits are situated. In our last issue we gave a map of the Transvaal which shows the position of Warmbaths, Nylstroom, Potgietersrust, and the Waterberg district generally. The vertical section also published herewith gives a general idea of the rocks in the Zaaipplaats district and indicates the range of country where tin is likely to be found. The feature of the geology is a comparatively recent intrusion of red granite that has lifted the Waterberg series of felsite, shale, conglomerate, and sandstone. This series corresponds to the Devonian system in England. The outcrop of the granite intrusion follows roughly a circular curve from the northeast to southwest on the map; to the northwest extends the Waterberg tableland under which the beds dip to the northwest. To the south and east is found the Bushveld complex of igneous rocks, including diabase, norite, and older granite, and also some of the Karroo rocks. The tin deposits are found in the red granite and in the felsite and shale of the lower Waterberg series at or near their junction; and in the Rooiberg district near the contact of the red granite and the Rooiberg sandstone which forms the lowest bed of the Waterberg series. In the Zaaipplaats district the orebodies are found in the shape of rich but limited pipes or lenses. Sufficient work has not yet been done to show how the ore occurs at depth, and whether the pipes will connect with deep fissures. The standard

books on the geology of South Africa though describing the rocks in this district do not mention tin. During the last two or three years the members of the Transvaal Geological Survey have made special inquiries into these deposits and their reports enter into considerable detail. It is on their reports that the article in the *South African Mining Journal* was founded. Two monographs relating to the tin districts have recently been published

Dawson's Reduction Furnace.—In *Mining Science* for March 23, Charles Dinsmore gives an account of a furnace designed by Oliver B. Dawson, of El Paso, for reducing metals from their ores without melting the gangue. This method of metallurgy has been tried or suggested by many investigators. For instance, it has been proposed for use at Tanganyika for the treatment of the copper carbonates, and F. B.



MAP OF THE WATERBERG TIN DISTRICT.



Vertical section east to west at Zampflins.

by the Survey. One, by H. Kynaston, describes the district between Warmbaths and Rooiberg, and the other, by E. T. Mellor, deals with a portion of the country north of Nylstroom. These are supplementary to papers previously published.

Dick of London is experimenting on the same lines. The idea is to reduce the oxide to metallic state and to remove the metallic granules from the gangue by some mechanical means such as jigs, table concentrators, or flotation plant. It is applicable for the treat-

shell and lined with firebrick. It is made to rotate on a horizontal axis. The ends are conical, at one end the gases are introduced for heating the charge, and from the other the products of combustion escape. In operating the furnace, the ore is introduced and is heated to the right temperature, 1300° or 1400° F., for the reaction, by means of oil or gaseous fuel. Then the fuel supply is cut off and the calculated amount of hot carbon is dumped into the charge. The inlet and outlet are immediately closed and the furnace made gas-tight. The furnace is then slowly revolved so as to thoroughly mix the ore and carbon. It is stated that from quarter of an hour to an hour is the time required for the completion of the reaction. The furnace is then opened and the charge dumped into a car that has small holes in the bottom through which steam is forced upward so as to prevent the metal from re-oxidizing. In a new furnace put up by Mr. Dawson the charge is first heated in a Wedge furnace and then transferred into the reducing furnace. The Wedge furnace could be used for preparing slime sulphide for treatment by this method.

Sampling Ores from Cobalt.—We have from time to time given details of the silver cres and concentrates obtained at Cobalt, Ontario, and have described the terms on which these are bought by the various smelters. We have also referred to the difficulties of sampling rich material of this kind containing arsenic, cobalt and bismuth. In the *Engineering and Mining Journal* for April 15, F. W. Pugsley, of the Perth Amboy works of the American Smelting & Refining Co., describes the practice there adopted. The ore or concentrate is first crushed to $\frac{3}{4}$ in. mesh and the nuggets removed by screening. The latter are melted and cast into bars. In assaying them three holes are bored, one in the centre and the others two-thirds of the way from the centre to the corner. The bars average 85% silver, the remainder being chiefly nickel, cobalt, and arsenic. The crushed ore after the removal of the nuggets is dumped on a steel floor in the form of a ridge. In order to mix the ore this ridge is divided by shovelling from both sides, and thus forming two ridges, which are then mixed again, and the ridge once more divided into two. These two ridges are divided into four by the same method. A man then starts on each of these four ridges placing alternate shovelfuls in bags and on the floor behind him. The remaining half ridges are then gone over again, bagging each alternate shovelful, until what remains of each ridge amounts to 1½ tons. These are coned and by means of a Jones divider are reduced to samples of about 300 lb. each, thus making four samples amounting altogether to 1200 lb. Each sample is passed through rolls so as to pass an 8-mesh screen. Much metallic silver is left behind on the screen; this is ground in a metallic grinder until it also will pass 8-mesh. The ground ore and metallics are then thoroughly mixed and a sample weighing 40 lb. obtained on a Jones divider. This is ground to 20-mesh and cut on a small riffle to about 1500 grammes, then dried for 12 hours and reduced to 100-mesh in a disc grinder. This process of sampling occupies 3 days and has been proved if worked properly to give results accurate to 0.5%. A careful study showed that with some of the concentrates the four samples would vary considerably. These concentrates contained quite 50% silica, which naturally constituted the coarser parts, while the richer parts would be the finest. In forming the

ridge the coarser and poorer parts would roll to the bottom leaving a central line of richer material. When the shovellers attacked the ridge from the two sides for the purpose of dividing it into two, unless the men on the opposite sides worked at exactly the same rate, more of the rich material would get into one of the two smaller ridges than the other. After much trial it was decided to damp these concentrates at the beginning so that the fine and coarse would adhere, and the coarse would not separate out by rolling to the bottom. The difference in the results of the four samples became immediately very much less. This method of damp-sampling is of interest to metallurgists who are troubled with the problem of dealing with ores and concentrates that contain the highest values in the finest portions, a problem that has received much attention in this magazine and elsewhere recently.

Silver Halogen Salts at Tonopah.—In *Economic Geology* for January, J. A. Burgess gives an account of the occurrence of silver chloride, bromide, and iodide in the Tonopah mines, Nevada. In desert regions these haloids are often found in the oxidized zones, and R. A. F. Penrose in 1894 first described their formation. The Tonopah ore deposits contain large amounts of these salts, and the manner of their occurrence is such as to afford a clear explanation of their origin. The author and A. S. Eakle have made conjointly a close study of the minerals contained in the Tonopah veins. The veins at Tonopah consist of quartz, and traverse what J. E. Spurr called at first 'early andesite' and subsequently 'trachyte.' The valuable minerals contained in the veins are argentite, polybasite, and gold. Some pyrite and chalcocopyrite are found, but in unimportant quantities, and pink rhodonite gives a characteristic colouring in places. There are also many other minerals metallic and otherwise associated with the veins in minute quantities, making the mineralogical study attractive, but not adding to the commercial value of the deposits. To a depth of about 700 ft. the veins are oxidized; the quartz is stained with iron and manganese, and much of the silver sulphide has been altered. It is in this zone that the haloids are found. The chloride or cerargyrite is the most plentiful and is always found in the upper levels. Iodyrite, the iodide of silver, is found in the lower part of the oxidized zone, and embolite, the chloro-bromide, is found in between and overlapping the two. In some parts of the Tonopah district a later andesite has flowed over the earlier andesite and so formed a capping through which the veins do not pass. Under this capping the veins have not been oxidized or altered and retain their primary condition. The uncapped veins having been subjected to much distortion are full of fissures through which surface waters have percolated downward. These waters contained various salts of chlorine, bromine, and iodine and, sulphate of silver having first been formed, the salts reacted on it with the formation of the silver haloids. The fact that the chloride is at the top and the iodide at the bottom is apparently at variance with this theory, for it would be expected that the iodide being least soluble would be precipitated first. The explanation may be that the great excess of alkaline chlorides present might cause the silver chloride to be precipitated before the bromide or iodide. The presence of manganese dioxide and sulphuric acid may also have influenced the reaction. The theory that the solutions were ascending and not descending does not hold good, because the alteration caused by them is greatest at the surface outcrops and is not observable at all where the veins are capped

with the later andesite. The author describes at length the method of occurrence of these haloids and proceeds to enumerate the associated minerals. Several tungsten minerals are found, also molybdate of lead, and phosphates such as apatite and turquoise. At one of the mines cinnabar is found as a coating on botryoidal pyrite, and is of comparatively recent deposition.

Metallurgical Plant at Benoni. — In our April issue under this heading we gave a brief outline of the new Benoni plant erected by E. J. Way. The *South African Mining Journal* for March 11 contains a detailed description of this plant together with a flow sheet which we reproduce herewith. The chief point about this design is that the sand and slime are mixed for treatment in the solvent solutions, separated by Stadler classifiers, and the solutions withdrawn from the slime by Arbuckle cones and from the sand by Caldecott filters; the same two types of machines are also used for thickening the slime and sand after tube-milling and before cyaniding. The ore first goes to 55 stamps of 2000 lb. each, where it is crushed to 3-mesh. The pulp passes to 4 Stadler classifiers from which the underflow passes to 4 tube-mills. The overflow joins the discharge from the tube-mills and is pumped to another set of 4 Stadler classifiers. The underflow from this second set goes to the tube-mills, and the overflow, which is all *minus* 60, goes to 28 shaking tables for amalgamation. The pulp then goes to the cyanide department and before treatment is thickened. For this purpose it is passed through primary and secondary Stadler classifiers. The underflow from the secondary classifiers is the sand and it is thickened on a Caldecott filter table; while the overflow from both sets is the slime and it is thickened on 3 Arbuckle cones. The thickened slime and sand are sent to 4 mixing agitators where they are mixed with the cyanide, and from there the cyanide pulp goes to 32 Way-Arbuckle treatment agitators. The process in this set of agitators is continuous, and the agitation is effected by compressed air. The time occupied is about 4 or 5 hours. Subsequently the cyanide pulp goes to another set of Stadler classifiers and the gold solution is withdrawn from the slime by Arbuckle cones and from the sand by a Caldecott filter. The slime and sand from which the gold solution has been withdrawn is sent to mixing agitators where a weak wash solution is added. After treatment in these, the pulp is once more separated into slime and sand, and the weak solution removed by Arbuckle cones and Caldecott filter. It will be seen that the conjoint treatment of the sand and slime simplifies the plant, and that the rapidity of the extraction of the gold is a notable advance. The erection of the plant has just been commenced.

FLOW SHEET OF THE RENONT MILL.

Origin of Native Copper Deposits.

Briefly it is that the copper was precipitated from alkaline chloride solutions contained in sandstones by the heat of lava flowing over these rocks. He first reviews certain features connected with various native copper deposits in North America, Bolivia, Germany, and elsewhere. First, they all occur in connection with red sedimentaries. Second, the deposition of the copper is attended by a blanching of the sandstones. Third, the red sedimentaries are associated with dark basaltic lavas which contain much ferrous iron and a small percentage (about 0.02%) of copper disseminated through them. Fourth, the water in the rocks, especially in depth, contains comparatively large amounts of chlorides of alkalis and alkaline earths. Fifth, the native copper is not found as part of fissure veins, but is in the nature of a replacement or an infiltration in the surrounding rock. Sixth, the copper is usually accompanied by zeolites, that is hydrated silicates of various bases that have been deposited from hot water as secondary products. It is generally admitted that the rocks in which native copper is found were formed at periods when the land stood high, and that the red rocks have been laid down on land. In early Cambrian times most of North America was out of water, even the Lake Superior basin, and it seems probable that the deposition of rocks continued in this basin during the period of elevation, forming a great series of lavas and red beds. During this prolonged process of erosion and redeposition, the copper in the lava flows would be leached out by the chloride waters and would remain in the saline waters of the desert, accumulating in concentrated form in the pools. Further lava flows would then cover the beds containing these pools, and subsequently in the course of ages, when the superimposed lavas cooled, water from the surface would be sucked in. The author in his investigations finds that solutions of alkaline and earthy chlorides if heated unequally will precipitate some of the copper at the hotter parts and his theory is that this has happened in the Lake Superior rocks. The copper here occurs near channels that have at one time been pervious, being in conglomerates and porous or fissured lava, and it is usual for it to be at the sides of the pervious channels rather than in the main channels. This indicates a contact deposit in a pervious bed or in its immediate neighbourhood, and filling fissures and joints in a less pervious bed. Thus the copper is found in the conglomerates and in fissures in the adjoining lava. This theory will explain how the copper occurs not in cross fissure veins but in beds over a wide area. Mr. Lane takes as an instance the Kearsarge lode that has been mined for 14 miles and contains smaller amounts of copper for two or three times this distance. Here a series of amygdaloidal traps has overflowed red fine-grained sandstone and shale. The latter formation is one such as would be formed by wind erosion and deposition. This formation would have on the surface alkaline pools containing copper, and when the lava overflowed the formation, the copper would be deposited in the porous parts of the lava flow. On the cooling and subsequently on the upheaval of these formations, the waters set circulating downward would cause a secondary enrichment, wherever cool solutions came in contact with hot rocks. The author elaborates the subject in detail and also discusses the question of the presence of other metals and compounds. For instance, anti-

mony is seldom found. It will be remembered that in the electrolytic refining of copper a little chloride salt is added to prevent antimony being deposited with the copper. Silver chloride is sufficiently soluble to accompany the copper in the proportion in which it is found.

Reopening Old Mines in Finland.—In the *Engineering and Mining Journal* for April 1, Dwight L. Woodbridge gives an account of the old Orjani mine in Finland, where a plant has recently been erected by the Minera's Separation company for the treatment of complex sulphides containing copper, zinc, silver and gold. This work is notable because it affords another example of American capital acquiring an old mine in the Russian Empire. The property is now owned by the Finnish-American Mining Co. It is situated in the province of Abo about 18 miles from the Gulf of Finland coast. Operations originally started in 1757 and were continued without a break for 118 years. One or two attempts were made to reopen them, but as they were full of water and the people undertaking the work had little experience or money, their efforts were not successful. In 1906, however, a number of Finns, who had learnt mining and made money in the Michigan copper district, purchased the properties, and they are doing well. The method of mining adopted by the old owners shows that they were out of touch with the rest of the world, in spite of the fact that their near neighbours, the Swedes, had an excellent system of mining. They did not use shafts, but opened a series of conical caves, the apex being at the surface, and the diameter of the excavation increasing as they went down. This was necessarily an uneconomical way of working, as both waste and ore had to be hauled up. On unwatering the mines, these caverns presented a dangerous condition, and men with modern ideas were confronted with unusual problems. Eventually it was considered best to use the old caverns as bases of operations instead of sinking a new shaft, and wire ropes were fixed vertically from the surface to the bottom of the cavities to serve as guides for haulage. The old miners had no explosives, and used to heat the rock by burning wood, and then disintegrate it by means of sprays of water. Mr. Woodbridge gives a graphic account of the horrors of these old workings. At the time of his examination he estimated the probable available ore at 175,000 tons, averaging 4% copper, and much more has since been disclosed. The ore is complex, consisting of chalcopyrite, pyrrhotite, and blende, with some galena. The old workers picked out the copper ores and left great quantities of blende on the dumps. An estimate showed that the dumps contain 1000 tons running 30% zinc, 6500 tons running 20% zinc, and great quantities of lower grade material. The higher grade ore was sorted out and collected by the old owners and some may have been utilized. The new plant now erected will treat the dump and mine ores; after crushing, the coarser material will be treated on Wilfleys, and the finer by the Minerals Separation process. Mr. Woodbridge, in describing the geological formation, records that the ore deposits are found in the northern limit of a great anticline. The foot-wall is granite and the hanging-wall diorite. Local geologists differ in opinion as to the probable persistence of the veins; Sederholm is inclined to think that they will not go down far. The old workers did not go farther than 300ft. Recent developments have disclosed a poorer zone at 400 ft., but at 500 ft. the ore is richer again. The results obtained by the new dressing plant will be watched with interest.

CURRENT LITERATURE

Faults in Rand Mines.—The February *Journal* of the Chemical, Metallurgical, and Mining Society of South Africa contains a paper by G. H. Beatty, discussing faults as found on the Rand, and giving hints on development work in broken ground.

Estimation of Ore Reserves.—In the *Bulletin*, Vol. 2, No. 1 of the Mexican Institute of Mining Engineers, G. A. Denny gives a paper describing the various methods of estimating and valuing ore reserves, criticizing each, and showing how errors arise through their injudicious application. The paper is intended as a basis for discussion.

The Square Fathom.—In the February issue of the *Journal* of the Chemical, Metallurgical, and Mining Society of South Africa, R. E. Sawyer takes up the discussion of the Marriott fathomage system, and brings forward certain aspects in which he considers the system has an advantage.

The Dunlap Screen.—*Mining Science* for April 13 describes the application of the Dunlap screen, hitherto used chiefly in connection with clay, for sizing damp ore. It is in use at the United States Reduction and Refining Co.'s works and at the Portland mine, Cripple Creek.

Gold Dredges.—The *Mining and Scientific Press* for April 8 gives a description with full working drawings of the steel spud designed by W. S. Noyes for the dredges of the El Oro Dredging Co. operating in California.

Restoring Dredged Ground.—The *Australian Mining Standard* for March 1 gives details of the methods of restoring dredged ground adopted in Victoria, Australia. This information is supplementary to that published in our March issue, and in addition refers to the legal disputes on the subject between the government, the farmers, and the gold dredging people.

Mining at Nome, Alaska.—In the *Mining and Scientific Press* for March 25 and April 1, T. M. Gibson describes in detail the profitable gold gravels on the beaches at Nome, Alaska.

Amalgamation on the Rand.—At the April meeting of the Institution of Mining and Metallurgy, a paper on the amalgamation of gold in banket ore, by W. R. Dowling, was presented for discussion. Mr. Dowling is metallurgist at Knights Deep, one of the Consolidated Gold Fields group. He traced the history of the subject and gave the arguments for and against amalgamation after the stamps or after the tube-mills, and described the relative claims of shaking and stationary plates.

Silver Metallurgy at Guanacevi.—In the *Mining and Scientific Press* for March 18, R. C. Kline describes the method of treating silver ore at Guanacevi, Durango, Mexico.

Filter-Press Practice in West Australia.—In the *Monthly Journal* of the Chamber of Mines of Western Australia for February, T. B. Stevens and W. R. Degenhardt, members of the staff of Bewick, Moreing & Co., give a lengthy paper, full of illustrations, describing details of practice in connection with the vacuum filter-press in Australia.

Canvas Tables.—In *The Mining World* (Chicago) for March 18 and 25, W. H. Storms writes on the use of canvas tables for saving fine sulphide that has not been caught on the vanners. He quotes the experience obtained at many gold mines in California.

Mining in Korea.—In the *Mining and Scientific Press* for April 1, Thomas T. Read describes the gold

mining operations in the Chicksan district, situated 40 miles south of Seoul, Korea. These properties include placers and vein mines and are being developed by a company organized by American and Japanese interests conjointly.

Geology of Petroleum.—In *Economic Geology* for January, Frederick G. Clapp contributes an article on the causes of accumulation of oil and gas along monoclines, and gives instances of occurrences of this kind in Ohio.

Precious Stones in the United States.—*The Mining World* (Chicago) for March 18 publishes an address before the Brooklyn Institute of Arts & Sciences on the occurrences of precious stones in Arkansas, Montana, California, and North Carolina, by C. Roe Gardiner, of Tiffany & Co.

Asbestos.—The February issue of the *Bulletin* of the Canadian Mining Institute contains a number of valuable papers relating to asbestos: Occurrence of Asbestos in the United States, by J. S. Diller; Deposits in New England, by C. H. Richardson; Breaking Asbestos Rocks, by E. Torrey.

Tellurides in Canada.—In the February issue of the *Bulletin* of the Canadian Mining Institute, D. D. Cairnes describes the occurrences of tellurium in Canada.

Gold in the Philippines.—In *Economic Geology* for March, H. G. Ferguson gives an outline of the geography and geology of the Philippine Islands, and describes the various occurrences of gold.

Geology of Cobalt.—The *Mining and Scientific Press* for March 18 reprints a paper read by S. F. Emmons before the Geological Society of Washington on the economic geology of the Cobalt district.

Zinc Distilling.—*Metallurgical and Chemical Engineering* for April contains an article by G. A. Wetengel describing a new form of zinc-distilling furnace. The retorts and the process are the same as usual, but the furnace is mounted on a rotatable framework, by means of which it is possible to charge the retorts while in a vertical position from trucks running on rails above the furnace. This furnace has been experimentally used in one of the Kansas works and it is reported to be a great labour saver; also it is said that the life of the retorts is notably prolonged.

Copper Converting.—In the *Engineering and Mining Journal* for April 8, Carr B. Neel, of Salt Lake City, gives a number of practical details in connection with the working of basic-lined copper converters.

Explosions of Matte.—In the *Engineering and Mining Journal* for April 15, W. C. Smith, of Grasselli, gives results of his investigations into the cause of explosions of matte. He does not find that they are caused by any constituents of the matte, or by the release of gases inside, but by the sudden generation of steam if the matte comes in contact with moisture or damp.

Meker's Gas Burner.—In *Metallurgical and Chemical Engineering* for April, Chester G. Fisher describes a new burner invented by Meker, a French chemist, to supersede the standard Bunsen. In this burner the theoretical proportion of air and gas to ensure perfect combustion can be used without the mixture firing back, and in this way a greater heat can be obtained than by a Bunsen, which uses for the purposes of safety a large excess of air.

Copies of the original papers and articles mentioned under 'Précis of Technology' and 'Current Literature' can be supplied on application to The Mining Magazine.

BOOKS REVIEWED

MINERALOGICAL TABLES FOR THE USE OF MINING MEN. By E. H. Kraus and W. F. Hunt. Cloth octavo, 260 pages. New York: McGraw-Hill Publishing Co. Price 5s. 6d. For sale by *The Mining Magazine*.

We recently recorded that this book was in preparation, and knowing its source, we predicted a large demand. Just as we go to press a copy has come to hand. It more than confirms our expectations. It is full of information valuable to the mining engineer. We shall give an extended review of the book in our next issue.

MODERN COPPER SMELTING. By Edward Peters. Cloth octavo, 610 pages with illustrations. New York: The McGraw-Hill Publishing Co. Price 12s. 6d. For sale by *The Mining Magazine*.

Good books are few and far between, and they are easily recognized when they do come along. Dr. Peters' previous books have been the best and most consistent sellers among modern technical works, a fact which shows their wide applicability and sterling worth. The present book is a substitute for his "Modern Copper Smelting," and is in no way a mere revised edition. We have not had time before going to press to thoroughly read the book, so we postpone a detailed review of it until next month, contenting ourselves in the meantime with this preliminary announcement.

OIL AND PETROLEUM MANUAL. By Walter R. Skinner. Cloth octavo, 180 pages with maps. London: Walter R. Skinner. Price 2s. 6d. For sale by *The Mining Magazine*.

The first edition of this book was published a year ago and immediately attained a wide circulation among those who want the details relating to companies interested in oil operations. The information is arranged in the same way as that in Skinner's Mining Manual. The importance of the oil industry to the City of London is exemplified by the fact that this manual contains details of 481 separate companies, an increase of 181 during the past year.

THE DREDGING OF GOLD PLACERS. By John Ernest Hodgson. Cloth octavo, 64 pages with illustrations. London: Sir Isaac Pitman & Sons. Price 5s.

The author is manager for the Ashanti Rivers and Concessions, Limited, Dunkwa, West Africa, and the book is intended to be a help to directors and shareholders rather than to dredging experts. It is a very small book, and is quite sketchy. The illustrations are pretty, but do not help; for instance the first is a view of a great dredge used for keeping the Suez canal in order.

ASSAYING AND METALLURGICAL ANALYSIS. By E. L. Rhead and A. Humboldt Sexton. Cloth octavo, 450 pages, with illustrations. London: Longmans Green & Co. Price 12s. 6d. For sale by *The Mining Magazine*.

This book was originally published in 1902 and has proved of value to students and chemists. Mr. Rhead is lecturer on Metallurgy at the Municipal School of Technology, Manchester, and Mr. Sexton has been connected, for many years, first as professor of metallurgy, and more recently as emeritus professor, with the Glasgow and West of Scotland Technical College. The new edition has been thoroughly revised and much new matter added.

TABLES FOR THE USE OF MINING MEN. By E. H. Kraus and W. F. Hunt. Cloth octavo, 260 pages. New York: McGraw-Hill Publishing Co. Price 5s. 6d. For sale by *The Mining Magazine*.

The authors of this book are the professor and instructor in mineralogy at the University of Michigan. The book consists of elaborate tables describing the properties of minerals. The classification is on different lines from usual, and follows a line often demanded by mining men. Minerals are divided into those with metallic lustre and those without; each class is then divided according to colour, and each sub-class divided according to the streak and hardness. The composition and chemical reactions are not made prominent. The book should be of interest and value in many ways.

RUSSIAN LAW ON THE PETROLEUM INDUSTRY. Edited by Eugene de Hautpick. Cloth octavo, 56 pages. London: *The Mining Journal*. Price 5s. For sale by *The Mining Magazine*.

This book will be useful to those interested in Russian oilfields. It gives a complete statement of the Russian Law affecting the location and working of oil properties.

MANUFACTURE OF SULPHURIC ACID AND ALKALI. VOL. III. By George Lunge. Revised edition. Cloth octavo, 762 pages with many illustrations. London: Gurney & Jackson. Price 30s. For sale by *The Mining Magazine*.

Volume 3 of Lunge's famous treatise has hitherto been devoted to alkali manufacture by processes other than the Leblanc, together with the production of chlorine and of other collateral or allied processes. In this new edition the subject has been found to have outgrown the limits of a single book, so the whole of the electrolytic processes have been relegated to a Volume 4 that is to be published shortly. The present volume describes the ammonia-soda process, and the production of soda from natural salts, such as cryolite, sulphate, and nitrate. The rest of the book is devoted to the manufacture of chlorine, bleaching-powder, and chlorates.

TRANSPORT FACILITIES IN SOUTH WALES. By Clarence S. Howells. Octavo, paper covers, 56 pages. London: P. S. King & Son; Cardiff: The Business Statistics Publishing Co. Price 2s. For sale by *The Mining Magazine*.

The department of Economics and Political Science in the University of South Wales and Monmouthshire, Cardiff, recently commenced the preparation of a series of monographs on the economics of the industries of South Wales. The professor in this department, and editor of these publications, H. Stanley Jevons, is the hereditary bearer of a time-honoured name in connection with political economy. The first of the series was by his pen, and dealt with 'Foreign Trade in Coal.' The second is the one now received. It describes briefly the main geological features of the South Wales coalfields, and the surface contour of the country. The ports, railways, and canals, are enumerated, and their disposition as dependent on the contour of the country explained. The trade of the various transport systems is dealt with, and their economic position relative to the earnings of the coal mines considered. The book would have been made more useful to the outside student by the provision of a map.

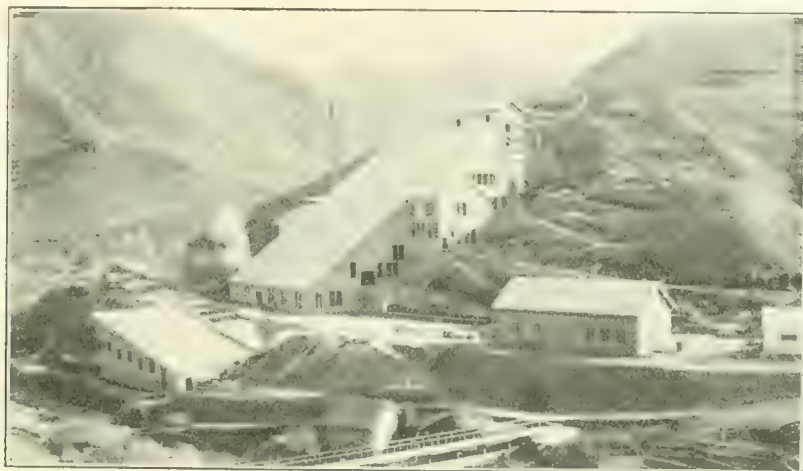
In looking through the prospectus of future volumes of this series we note one on the history of the copper industry of Swansea and district.

COMPANY REPORTS

Tronoh.—This is one of the leading tin mines in Perak, Federated Malay States, and, under the management of Harry D. Griffiths, has emerged from a brief period of depression into one of increased prosperity. It was introduced in England by Foo Choo Choon and E. G. Edgar in 1901 who continued to direct operations on the spot. For some years large profits were made, and from 1902 to 1907 £244,000 was distributed as dividends on a capital of £160,000. In 1908 no profit was made. The tin is found in gravels some of which are on the surface and others in the form of deep leads. The mining proposition was easy enough at first, but as time went on conditions altered and the local directors were not capable of grappling with the difficulties. Another engineer was sent out from England, but did no better and finally three years ago Mr. Griffiths was appointed. He made certain recommendations for rearranging the work,

proved by boreholes to be a valuable property, though on account of the treacherous nature of the overburden it will have to be worked by opencut.

Seoul Mining.—This is an American company owning the Suan copper-gold mine in the province of Hwang Hai, Korea. The property was originally developed by an English company called the Korea Syndicate but operations were not successful. Three years ago, Messrs Collbran and Bostwick took over the concession, agreeing to pay the Syndicate 20% of the profits. They formed the present company with an issued capital of \$400,000. A 20-stamp mill was built in 1909 and started operations on December 1 of that year. Developments continued to be so satisfactory that another 20 stamps were erected in 1910 and started work on December 1. The metallurgical problem has not yet been completely solved, for bismuth interferes with gold extraction, and the concentrators which follow the stamps do not recover much of the copper. The report of the company for 1910 shows that 32,793



THE SEUL COMPANY'S MILL

and the directors consulted R. J. Frecheville before finally accepting them. Mr. Frecheville agreed entirely with Mr. Griffiths' views. The report for the year 1910 now issued shows that Mr. Griffiths has done excellent work in every direction and that the output and profit have strikingly advanced. The amount of gravel treated was 410,777 cu. yd., as compared with 292,825 cu. yd. in 1909, and 156,366 cu. yd. in 1908. The production of tin concentrate was 2945 tons, as compared with 2158 tons in 1909, and 1712 tons in 1908. The price averaged £92 per ton, as compared with £80½ in 1909 and £72½ in 1908, and the total receipts were £271,304, as compared with £167,755 in 1909 and £123,683 in 1908. The yield per cubic yard under Mr. Griffiths' regime is about one-half what it was five years ago, the reason being that the old method of picking the richer patches introduced the danger of a total collapse of the workings. The profit for the year was £72,927, as compared with £38,774 in 1909, and the dividend was £56,000 or 35%, compared with £16,000 or 10% in 1909. Mr. Griffiths gives a detailed account of the developments at the various properties and shows that, by means of the pumps he installed, No. 2 mine has become the chief producer, and that the Eastern Lead has been

tons of ore was sent to the mill, and 707 tons of hand-picked ore and 389 tons of concentrate was shipped to Tacoma. The bullion produced in the mill was worth \$263,482, or \$8.03 per ton, and the ore and concentrate realized \$104,468. The profit was \$215,151, out of which \$64,597 was used for capital expenditure, chiefly for the purchase of the additional plant, and \$100,000 has been distributed as dividend. As regards the extraction, 67% of the gold content is recovered on the plates and 11% in the concentrate, making a total of 78%. The recovery of copper is only 18%, a fact which shows that the concentration plant is unsuitable to its work, losing not only copper but also gold. The ore reserves on December 31 were 190,100 tons, assaying 13.42 gold and 1.76% copper. Since then rich ore has been found on the 400 ft. level.

North Broken Hill.—A year ago we recorded that this mine, situated at the extreme north of the Barrier Range, New South Wales, had become one of the two most prosperous in the district, and that in spite of the depression in the prices of metals the profits were rapidly increasing. The first part of the new concentrating plant was put into commission in September 1909, and the remainder about midsummer 1910. The present capacity is 6000 tons per week, but this level

tory development at the mine. During the six months

the largest proportion, 56,690 tons, came from the 950 ft. level, the remainder coming from the 500 ft., 600 ft., 700 ft., 800 ft., and 1100 ft. levels. The amount treated in the concentration plant was 136,044 tons, averaging 15.8% lead, 13.3% zinc, and 6.3 oz. silver; 23,011 tons of lead concentrate was produced assay-

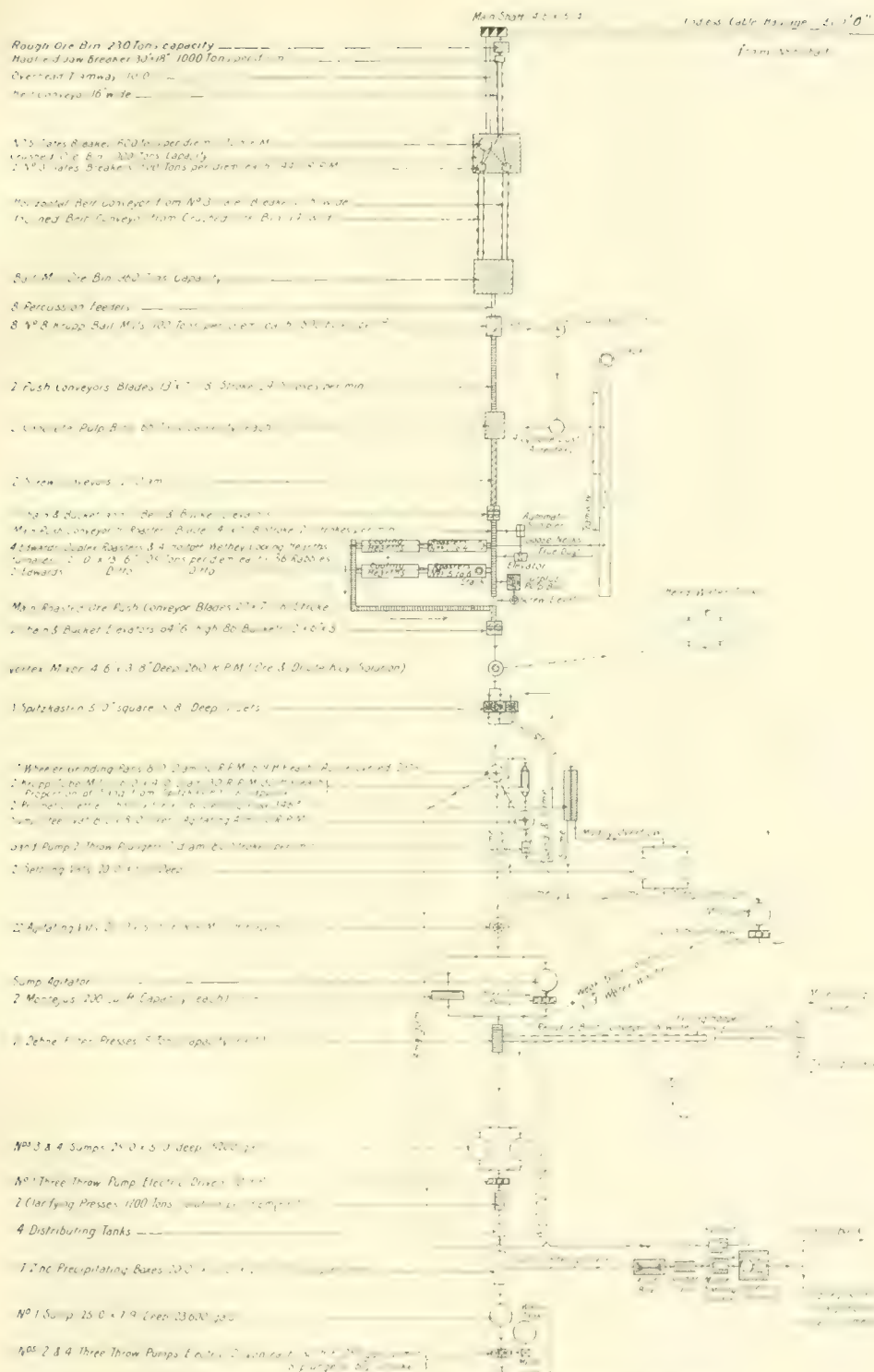
amount of zinc tailing produced was 67,757 tons averaging 3.6% lead, 17% zinc, and 3.2 oz. silver. This was sent to the De Bavy Company's plant which is situated just to the north of the mine. In addition 15,445 tons of slime was produced assaying 12% lead, 16.3% zinc, and 7.6 oz. silver, together with 29,831 tons of useless tailing. It is of interest to note that a small plant has been built for the treatment of the slime and that the results so far obtained are promising. As regards ore reserves, it is estimated that there are 1,500,000 tons available above the 1100 ft. level. At two points on this level the orebody is over 70 ft. wide. A winze from this level has gone down 45 ft. in good average ore, but further sinking is impossible just now owing to influx of water. The main shaft is down 1331 ft. and a level is being opened at 1250 ft. A Sirocco fan has been installed at the old hauling shaft capable of exhausting 70,000 cu. ft. of air per minute. The working cost of mining and milling was 11s. 6d. per ton, and of development 1s. 9d. The income during the half-year was £164,629 and the profit £61,000; £16,328 was written off and £35,000 distributed as dividend, at the rate of 20%.

Great Boulder Perseverance.—In the notice of this company in our issue of June 1910 we gave a history of this Kalgoorlie mine and recorded how it fell suddenly from a rich producer to a comparatively low grade proposition. Hooper Speak & Feilding are the general managers, and the direction of operations is in the hands of their local partner, R. A. Varden. It will be remembered that in November 1909 part of the surface plant was destroyed by fire. The main driving engine, the air compressors, Griffin mills, Edwards roasting furnaces, and their subsidiary equipments were entirely lost. Rebuilding was commenced immediately and Krupp dry ball-mills were substituted for Griffins. The rebuilt plant went into commission on August 1. The accompanying chart shows the course of metallurgical treatment. The report now issued covers the year 1910. During this time development work was actively continued at the mine. The main shaft reached a depth of 2228 ft. by April 1911. A new level has been opened at 2050 ft. where profitable ore has been found in the south drift, and cross-cuts are being driven at 2200 ft. On December 31 the reserve consisted of 120,134 tons of broken ore in the stopes (shrinkage stoping being the method employed) with contents averaging 6.55 dwt. per ton, 362,700 tons of proved ore averaging 5.95 dwt., and 289,380 tons of probable ore averaging 5.08 dwt., a total of 772,214 tons, as compared with 629,852 tons the year before. During the five months August to December 91,852 tons was milled, yielding 27,013 oz. and 3408 oz. silver having a total value of £115,083. The extraction of gold was 79%, but as gold is always locked up on starting new plant this figure will improve later. The capacity of the plant is 20,000 tons per month and the maximum is determined by the capacity of the roasting furnace. During the time

the mill was running the working costs averaged 19s. 1d. per ton, and were reduced from 24s. 2d. in August 1910 to 18s. 6d. at the end of the year, but owing to the expense of delayed treatment and equipment continuing during the rebuilding of the mill, the result of the year's work has been a loss of £20,913. The balance sheet shows an item: 'Addition to Plant Machinery and Buildings during 1910, £44,636,' and on the other side: 'Bankers' Overdraft and Interest £42,650.' This, together with the announcement made a year ago that £20,000 had been recovered from the insurance company, explains the method of financing the rebuilding of the plant.

Ivanhoe.—This gold mine at Kalgoorlie, Western Australia, is situated between the Great Boulder Proprietary and the Golden Horse-Shoe. It was purchased from the local owners by Whitaker Wright in 1897, and when the career of that financier came to an untimely end, Bewick, Moreing & Co. were made consulting engineers. F. A. Govett is chairman and Robert B. Nicolson is manager. Up to the present time gold worth £6,082,973 has been extracted and £2,690,000 has been paid as dividends; as the reserve of ore on December 31 stood at about four years supply the prospects of future profits are promising. Except for the fact that at the northern end of the property the vein partly dips into the Proprietary's ground on some of the lower levels, the developments are as satisfactory as at any of the Kalgoorlie mines. The report for 1910 shows that during the year the 100 stamps crushed 232,842 tons of ore yielding by amalgamation gold to the value of £131,332. The concentrators produced 21,313 tons of sulpho-tellurides, which after roasting yielded gold worth £117,407. In addition 105,154 tons of sand yielded gold worth £62,184, and 106,375 tons of slime yielded gold worth £182,163. The total yield was worth £493,086, or 42s. 4d. per ton, an extraction of 89%. The profit was £236,785, out of which £220,000 has been distributed as dividend. The manager estimated the ore reserve on December 31 at 985,036 tons, worth 44s. 10d., and the consulting engineers' staff gave higher figures, namely, 1,089,463 tons worth 45s. During the year two tube-mills have been erected in order to help the grinding pans which follow the stamps, and additional tables have been provided for the extraction of concentrate. It is expected that the capacity will in future be 20,000 tons per month.

Sons of Gwalia.—This gold mine is situated near Mount Leonora in the North Coolgardie district of Western Australia. The company was floated in 1898 by the London and Western Australian Exploration Co., of which Bewick, Moreing & Co. were the moving spirits. The management of the mine is still in the hands of this firm. Though not now yielding such rich ore as in the years 1903 to 1905, the mine is in a distinctly healthy condition and promises well for the future. The main incline shaft is down 2503 ft. and in order to protect the dip additional claims have been acquired during the year. Development work continues to reveal large bodies of ore with here and there rich shoots. On December 31 the reserves were 3½ years ahead of the mill. The report for 1910 shows that 162,082 tons was raised and sent to the 50 stamps. By amalgamation 44,002 oz. was recovered, 6326 oz. was obtained from concentrate, 10,106 oz. from sand, 5596 oz. from slime, and 704 oz. from slag and accumulated slime, making a total production of 66,734 oz. or 35s. per ton milled. The net profit after payment of taxes and making allowance for depreciation was £112,360, out of which £97,500 was paid as dividend being at the rate of 30%.



FLOW SHEET of GEL AT BOLDBER PRESERVANCE MLL

Tharsis Sulphur & Copper

property and plant. The balance-sheet shows the mine and plant at a purely nominal figure, and the company holds cash and securities to the amount of £1,084,205, which is nearly equal to the capital of the company, £1,250,000. During the year 1910, the production of copper fell to 3494 tons, as compared with 4357 tons in 1909. Of the three mines, the Calanas is the largest producer, the amount of sulphur and copper ore raised being 310,719 tons, and the total from all three 362,750 tons. In fact, nothing is being raised from Lagunazo nowadays, though the leaching heaps are still yielding sulphur ore and copper precipitate. The developments at depth at the Calanas mine have recently added ore reserves sufficient for 6 years. The amount of sulphur ore shipped during 1910 was 465,406 tons. The iron content of the sulphur ore is yielding an increasing revenue. The dividend for 1910 was at the rate of 12½%, the amount distributed being £156,250. This amount is the same as that paid in 1908 and 1909. The directors do not say how long the mines are expected to last, and they mention that all negotiations for the acquirement of new properties have fallen through.

Mason & Barry.—This company was formed in 1878 to acquire the San Domingos copper and sulphur mine at Mertola, Portugal. The mine is situated near the Spanish border, and is on the line of pyrite deposits usually identified with Huelva, Spain. Since 1892 the profits have been smaller than in earlier years, and the nominal capital of the company has been gradually reduced so as to more accurately represent the actual value of the property. The capital is £185,172 in £1 shares, just one-fifth of what it was fifteen years ago. The report for the year 1910 shows that 360,406 tons of ore was raised, as compared with 308,987 tons in 1909, and the shipments, including washed ore, were 294,443 tons compared with 264,914 tons. The profit for the year was £65,458, out of which £55,551 has been distributed as dividend, being at the rate of 30%. Since 1892, when the company was reconstructed, £1,101,767 has been paid as dividends, and £740,688 distributed to shareholders in cash as a return of capital.

Globe & Phoenix.—We have on many occasions recorded the progress of this celebrated Rhodesian gold mine, and need not on this occasion give any outline of its history. During the year 1910, the period covered by the present report, the mill was not running full time owing to the retimbering of the main shaft, and development was also suspended until September. The policy adopted was to send ore of higher than the average grade to the stamps so as to bring the total yield to what it would be if the mill were in operation for the whole year on average ore. The results were that 88,397 oz. was recovered from 41,257 tons of ore, an average extraction of 42.85 dwt. per ton. In addition 473 oz. was obtained by re-treating tailing, and the total value of the production was £376,372. The net profit after allowing for taxes and depreciation was £236,569, out of which £230,000 has been distributed as dividend, at the rate of 115%. On December 31 the estimated reserve was 178,221 tons averaging 33.9 dwt., figures not differing much from those published from time to time during 1910. The directors' report is accompanied by those of H. A.

Piper, the consulting engineer, and Theodore Haddon, the manager. The most important feature of the new arrangement of the plant devised by H. T. Brett is giving good results, the extraction having risen from 75 to 80%. The additional plant consists of Wheeler pans, concentrators, and roasting furnace for the concentrate. The last-named did not come into use until December, and when it is in regular work the extraction will be further increased. It is possible that eventually the plant may again be modified by the adoption of all-slitting. The main shaft is now down 2481 ft. on the incline or 57 ft. below the 18th level. Most of the development work has been on the 16th and 17th levels, and the orebodies continue to contain very rich shoots of ore.

Quincy Copper.—This company was formed as long ago as 1848 for the purpose of working property at Hancock in the centre of the Michigan copper district. The first dividend paid by the company was in 1862, and up to the end of 1910 the total amount distributed was \$19,440,000. Until 1900 the development was not done in a systematic way, such as is suitable for large operations at great depth. For instance, the shafts, which are really inclines, were not sunk with precision and rapid hauling was out of the question. It became obvious that as the workings had got down at that time to 3000 ft. vertical, some drastic reorganization was necessary. Consequently during recent years much money has been spent in sinking new inclines, straightening main levels, etc. In addition, the Pewabic and Franklin mines were acquired. At the present time the mine equipment and the dressing plant are both thoroughly up-to-date, and developments are kept well ahead of stoping operations. The copper is found native in an amygdaloid melaphyre. The ore is crushed by steam stamps and jigged, the concentrate produced containing on an average 40% of metal. The deepest workings at Quincy are now 4000 ft. deep vertically. The lode at the surface dips at 55°, and gradually flattens as it goes down, and in the present deepest part the dip is 37°. The rate of haulage is 4000 tons per day, and the average content is 15lb. per ton. The report now issued covers the year 1910, and the record of output and general progress is practically a duplicate of that issued last year. The most interesting point is that the company has purchased additional property, which is definitely proved to contain continuations of shoots in the Pewabic lode, and thereby the life of the company has been substantially extended. During 1910, the amount of ore raised was 1,373,124 short tons, and the production of copper was 10,048 long tons. The receipts from the sale of this copper were \$2,974,086, and the net profits were \$642,693. Dividends absorbed \$495,000, and \$150,000 was paid as the first instalment of \$600,000, the purchase price of the new property acquired during the year.

Ducktown Sulphur, Copper & Iron.—This company was formed in London in 1891 to acquire pyrite mines in Tennessee and has paid dividends continuously. We have recently published technical information relating to the smelting methods and the recovery of sulphuric acid. The report for the year 1910 shows that a profit of £38,376 was made. Out of this £4000 was allowed for depreciation, £2792. 10s. was paid as debenture interest, £6000 placed to reserve, £18,814 paid as dividend on the ordinary shares being 10% less income tax, and £5644 distributed on the founders' shares. The production during the year was 2200 tons of copper obtained by smelting 128,583 tons of ore, as compared with 2446 tons from 140,504 tons produced during 1909. The production of sul-

phuric acid was 46,500 tons. Important alterations and additions to the furnaces and power plant have been made during the year, whereby the amount of copper and acid will be increased and the smelting costs reduced. The cost of these improvements will be about £50,000 which will be provided by the issue of further debentures. The new shaft at the Mary mine has been completed and it gives access to a large body of recently developed ore. The East Tennessee mine has been fully equipped and is now yielding regularly. The business of this company has grown so much during the last year or two that two additional directors have been elected to the board.

Inspiration Copper.—This mine adjoins the Miami in Arizona. William B. Thompson is president of the company, W. H. Aldridge is managing director, Henry Krumb consulting engineer, and T. R. Drummond manager. It belongs to the class of disseminated de-

small experimental plant. These trials have so far been satisfactory and it is intended in a short time to erect a plant with a capacity of 5000 tons per day. Henry Krumb gives a short account of the nature of the ore deposit and of the method of estimating reserves. The copper sulphides are found in small seams and veinlets, and also in the form of minute grains disseminated through the rock which consists of silicified schist and granite porphyry, chiefly the former. The deposit is a secondary enrichment. The leached capping is on an average 367 ft. thick, and the enriched zone which forms the limit of commercial ore is 155 ft. thick. This orebody has been proved for a length of 3400 ft. and a maximum width of 1400 ft. The area so far developed is 40 acres out of 581 owned by the company, and the content per acre is 543,000 tons. To date 27,526 ft. of underground development work has been done, and 81 drill holes



PLAN OF THE INSPIRATION PROPERTIES.

posits characteristic of the present development of the United States copper mining industry. The capital is ten million dollars in 1,000,000 shares of \$10 each. The bonds have been redeemed, and the preference shares have all been converted to ordinary. Development of the property was commenced in February 1909. The first annual report now issued covers the period from the formation of the company to December 31 last. Still more recent information contained in the report consists of the cabled message to the effect that on March 1 of this year the developed ore amounted to 18,738,000 tons and the partly developed to 3,490,000 tons, making a total reserve of 22,228,000 tons averaging 2% copper. No concentrator has yet been erected, though tests are being conducted with a

aggregating 45,433 ft. have been driven. Ore is considered 'developed' when bounded by either drill holes or workings that are not more than 200 ft. apart. If the drill holes are more than 200 ft. apart but not more than 400 ft. the ore is reckoned as 'partly developed.'

Princess Estate.—This gold mine belongs to the Goerz group and is situated at the end of the middle west Rand where there is a gap in the reef between the Princess and the French Rand. The company was formed in 1888 and 30 stamps commenced crushing in 1892. The present equipment consists of 60 stamps. Dividends have been paid in 1897, 1899, 1908, 1909, and 1910, the total amount distributed having been £155,875. Since the beginning of 1909 the issued

Deep, were acquired, and the capital increased by the 108,333 for the Central property, and 132,700 shares to be offered for subscription for cash. The report of the Princess company for 1910 shows that 181,182 tons of ore was mined, and after the removal of 33% waste, 120,414 tons was sent to the mill assaying just over 12 oz. per ton. In addition 34,987 tons of accumulated slime yielded 2204 oz. The total production was 46,191 oz. worth £195,499, and the working cost was £137,068, leaving a profit of £58,431.

Vogelstruis Consolidated Deep.—This mine is situated in the Western Rand and belongs to the Neumann group. It has not been profitable so far, and is at present closed awaiting funds for further developments. The company was originally formed in 1895, and the share capital has been gradually increased to £259,396, in addition to which debentures to the amount of £121,300, have been issued. From 1906 to 1908 operations were suspended, and since then a 40-stamp battery and cyanide plant has been erected. Milling started in January 1910, but was discontinued in July. The report for the year 1910 just issued shows that during the time the mill was at work, from January 1 to July 31, 51,452 tons was raised from the mine and, after sorting, 41,258 tons was sent to the battery. The yield by amalgamation and cyanide was 12,436 oz., an extraction of 6 dwt. or 25s. 2d. per ton. On the final clean up in August an additional amount of gold worth £3694 was recovered. During this time the working cost was 29s. 10d. per ton, showing a loss of 4s. 8d. per ton. The high cost was caused chiefly by the rawness of native labour. The reserve of ore on July 31 was estimated at 149,530 tons averaging 5.9 dwt. It was decided to suspend milling until development work had disclosed larger amounts of ore. For the purpose of continuing this work it was proposed to raise £190,000 on debentures, but the issue was a failure and the mine was closed pending reconsideration of the position generally.

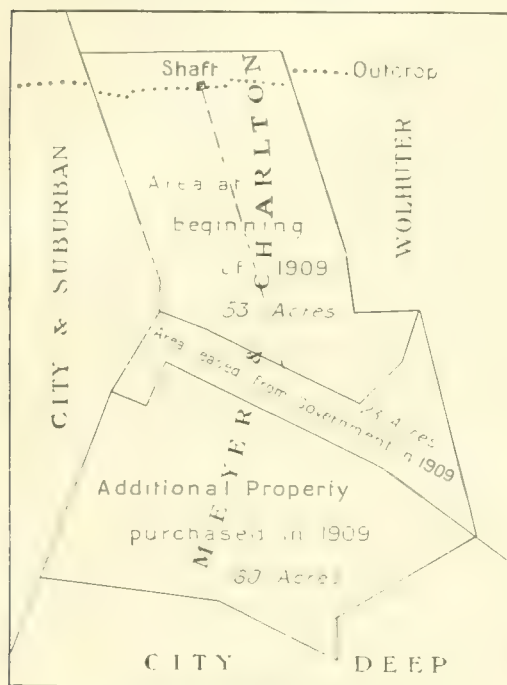
Witwatersrand Deep.—This mine is on the dip, south of the Ginsberg and Witwatersrand Gold Mine (commonly called Knights), and its eastern boundary adjoins the East Rand Proprietary Mines. It belongs to the Neumann group, whereas the outcrop mines belong to the Barnatos. The company was formed in 1895 and milling started in 1902, using the Balmoral plant. In 1904 the company's own plant of 245 stamps and 4 tube-mills was put in commission, and in 1906 the first dividend was paid. To the end of 1910 the distribution has totalled £1,302,593, being 250% on the capital. The report now issued covers the year 1910. During the year much trouble has been caused by influx of water, and in the western parts the work has had to be suspended until the completion of a new pumping plant. This plant is now practically complete. In spite of this interruption the development and mining operations have been continued without a break. The development work has disclosed 362,753 tons, averaging 7.31 dwt., and the reserve on December 31 stood at 1,692,922 tons, averaging 7.16 dwt., figures practically the same as a year before. The lowest level is now the 18th on the East shaft, and the ore here averages 12 dwt. over 77 inches. During 1910 the amount of ore raised was 514,401 tons, and after

the removal of waste 474,660 tons was sent to the mill where 121,704 oz. was recovered by amalgamation. The cyanide plant extracted 47,315 oz., making the total production 169,059 oz. The income from the sale of gold was £707,492, and the working cost was £481,000. Amortisation on the debentures issued and expenditure on capital account amounted to a further £56,000. The dividend absorbed £271,824, being 50% on the issued capital.

Nigel Gold.—This mine is in the Heidelberg district of the Transvaal on the southern continuation of the Witwatersrand outcrop, and it is situated about 16 miles due south of the active mines in the far east Rand. It is owned by a Natal company and has been continuously working with good results since 1888. Unfortunately during the last few months the labour supply has seriously fallen off, necessitating the stoppage of part of the stamp-mill and the restriction of development work. The report now issued covers 18 months from July 1, 1909, to December 31, 1910, the odd period being due to a change in the termination of the financial year from June to December. The number of stamps was increased in May 1910 from 55 to 75, but toward the end of the year it was found necessary to reduce the number once more to 55, for the reason already given. During the whole 18 months the average number running was 60, and the amount crushed was 208,880 tons, averaging 7½ dwt. The yield by amalgamation was 37,980 oz., and by cyanide 35,790 oz. In addition, 5247 oz. was recovered from accumulated slime, making a total production of 79,019 oz., worth £332,596. The working expenses were £223,545, out of which £18,000 was allocated to the return of borrowed capital, £16,565 went as profits tax, and £13,186 was allowed for depreciation. In December 1909 and June 1910 interim dividends of 15% each were paid absorbing altogether £66,931. The fall in profits has made it impossible to declare any further dividend at the close of 1910. Robert Curnow, the manager, reports that the ore reserve on December 31 last was 227,304 tons, with an average content of over 7 dwt. He also states that 522,261 tons averages under 7 dwt., but does not say whether it would be profitable to treat. Owing to scarcity of labour, machine drills were tried, but it was found that by their use much of the sandstone gangue was reduced to such small pieces that it could not be removed by hand sorting, so their use had to be abandoned.

Worcester Exploration & Gold.—This company was formed in 1887, being registered in Cape Colony, for the purpose of working a small property on the Rand outcrop, between the Robinson and Ferreira mines. After paying handsome profits on a small capital for eleven years, the mine was sold in 1903 for £90,000 cash to the Ferreira. The directors had previously acquired the Kentish and Bonnie Dundee properties situated 15 miles northeast of Barberton. In 1904 these properties were actively developed, and 40 stamps and cyanide plant were erected. In 1909 a tube-mill was added. The report now issued covers the year 1910, and shows that 55,330 tons of ore was milled, yielding by amalgamation and cyanide 16,366 oz., worth £69,264. The profit was £25,177, out of which £16,751 has been distributed as dividend, being at the rate of 17½%. The mine is now down to the 7th level, which is opening up satisfactorily. A suction gas-engine has been added as an auxiliary to the water-power plant. R. Wormald is manager, and Michael Doed consulting engineer. The original founder of the company, J. D. Hugo, died during the past year.

Meyer & Charlton.—This is one of the oldest producing properties on the Rand, and is situated in the central part on the outcrop, between the City & Suburban and the Wolhuter. The City Deep owns the deep levels. The control is with the Albu group. Operations commenced in 1888 with 30 stamps, and the plant has been gradually extended until it now consists of 75 modern stamps, tube-mills, and cyanide plant. The property was approaching exhaustion in 1909 and the company acquired additional claims on the dip and leased an intervening water-right ground from the government. Thus the life of the company has been extended 18 years. The work of the engineers during the last two years has consisted of clearing up the remaining ore in the old part of the mine, and of developing what is practically a new mine. In



Plan of the Meyer and Charlton

1909 nothing but cleanings from the old mine were sent to the mill, but in 1910 some ore from the new ground has been raised. These facts should be remembered when reading that the yield per ton in 1910 was five shillings greater than in 1909, and that the ore reserve was 49,000 tons less at the end of 1910 than a year previously. The report of the manager, H. G. Nich, shows that during 1910 the ore mined was 170,110 tons, and after the removal of waste, 153,717 tons, averaging 8 dwt., went to the mill. Amalgamation yielded 16,949 oz., and cyaniding 39,209 oz.; in addition 3722 oz. was recovered from accumulated slime, making the total production 59,880 oz. The income was £253,536, and the working cost £145,920. The dividend distributed absorbed £80,000, bringing the total distribution to date £955,308, from a production of gold worth £3,485,523. The ore reserve on December 31 was estimated at 277,029 tons averaging 7.8 dwt. The ore at this mine contains a good deal of pyrite and the maintenance of a high extraction is not easy. In July last it was found advis-

able to put in blanket tables to catch some of the pyrite, and they have proved fairly satisfactory. As regards the capital of the company, this was raised from £100,000 to £200,000 in 1909, when the additional property was acquired. At that time the new shares were issued at £3, and the money so raised was used to pay for the claims in cash and to provide working capital for shaft-sinking and development work on the new property. The consideration to the government for the leased ground is equivalent to the payment of 11% of the net yearly production. During March production was stopped pending repairs to the shaft.

New Goch.—This gold mine is in the central part of the Rand on the outcrop. Much work was done by various companies with varying interests in the earlier days, and it is only within the last three years that profits have been made. The control is now with the Albu group. The first dividend was paid in 1909. The plant consists of 120 stamps and 3 tube-mills. The capital of the company is £550,000, and there are also debentures outstanding to the amount of £206,325. The report for the year 1910 shows that 422,832 tons of ore was raised, and after discarding 20% waste, 338,618 tons was sent to the stamps. By amalgamation after the stamps and tube-mills, 58,723 oz. of gold was recovered, and the cyanide plant extracted 35,510 oz. The total yield was 94,233 oz. worth £399,196, being an extraction of 5½ dwt. or 23s. 6d. per ton. The working cost was £258,569, or 15s. 3d. per ton, leaving a profit of £140,626, or 8s. 3d. per ton. After paying interest on debentures, providing for redemption of debentures, and paying taxes, it was possible to distribute two dividends absorbing together £82,500. As recorded in our issue of July 1910 the first dividend declared by the company was earned in 1909, and the above-named two dividends are numbered 2 and 3. As regards ore reserves, the manager, E. H. Bulman, reports that on December 31 last there was 741,688 tons averaging 5.34 dwt., and also 375,357 tons averaging 3.04 dwt., the value of which as ore was problematical. The amount of better class ore developed during the year is less than the amount extracted and milled, but the total reserve now reported is greater, the reason being that much of the lower grade ore is now reckoned profitable.

Cinderella Consolidated.—In our issue of May 1910 we recorded the formation of this company, as an amalgamation of the Cinderella Deep and other properties of the Albu group situated in the eastern Rand. The Cinderella Deep was the only producing property. It is the continuation on the dip of the Cason mine, which is part of the East Rand Proprietary. The rest of the property absorbed in the consolidation lies to the southeast and is presumably on the dip of the Boksburg and other outcrop properties the value of which has not so far been proved. The report of the Cinderella Consolidated now issued covers the year 1910, the company being a continuation of the Cinderella Deep. The report recapitulates the terms of amalgamation with the other properties and fully explains the financial position. The mine cannot be worked at full capacity as yet, because it has not the necessary two outlets required by Transvaal law. To provide this outlet it is planned to make connection with the Angelo Deep section of the East Rand Proprietary, and this is expected to be done in a month or so. In the meantime only a part of the plant consisting of 100 stamps and 3 tube-mills is employed. During 1910, the amount of ore raised was 207,495 tons, and after rejecting 12½% waste, 181,100 tons assaying 7.7

affected during the latter half of the year by the scarcity of labour. The total working expenses were £208,613. The yield per ton was 28s. 4d., and the cost 23s. After the payment of debenture interest, taxes, etc., the profit for the year was £43,225, which added to the balance brought forward from the previous year gives a credit balance of £100,871. Until the disability in connection with underground work is removed the directors recommend no distribution of profits. F. W. Girdler-Brown, the manager, reports that on December 31 the ore reserve was 421,884 tons, averaging 6.78 dwt., and he also includes a large amount of frankly 'unpayable.'

Aurora West.—This gold mine is in the middle west Rand on the outcrop, and is an isolated member of the Albu group. The company was formed originally in 1889, and has been reconstructed twice, the last time in 1895. Milling first started in 1892, but was suspended in 1894. It was resumed in 1899, but was stopped soon after by the war. It was not until 1908 that operations once more began. In that year a 60-stamp mill was erected, together with cyanide plant, and was put in commission in August. The report now issued covers the year 1910, and shows that 159,228 tons of ore was mined, and after the rejection of 19% as waste, 128,163 tons was sent to the mill. The yield by amalgamation was 24,371 oz., and by cyanide 11,508 oz., a total of 35,879 oz., valued at £151,834, or 23s. 8d. per ton milled. The working cost was £120,622, or 18s. 10d. per ton. Out of the profit, £11,982 was paid as interest on £165,702 advanced by the parent company the General Mining & Finance Corporation, and the balance £18,849 was carried forward. During the year an attempt was made to liquidate the debt to the parent company, but the results for 1909 were not sufficiently satisfactory to induce shareholders to exercise their option on unissued shares. The share capital therefore remains at £212,705. Steps will be taken later on to dispose of the remaining 149,795 shares. The directors are intending to add two tube-mills and further cyanide plant, and so increase the monthly capacity from 11,000 tons to 14,000 tons. The cost, £25,000, will be met by advances made by the parent company. As regards reserves, the manager, J. P. Ward, estimates that the ore above 4 dwt. amounts to 339,000 tons, averaging 5.85 dwt. It is noteworthy that since May 15 last the mine has been run on single shift.

West Rand Consolidated.—This company was formed in 1903 as a consolidation of a number of properties in the far west Rand, situated to the east of the Robinson-Randfontein mines, and owned by the Albu, Neumann, and Goerz groups. The control is with the Albus. The mine and mill of the Violet company were acquired in 1907. Milling commenced in September 1908, and the metallurgical plant now consists of 100 stamps and four tube-mills. The report for 1910 just published shows that an average of 83 stamps and 3 tube-mills were at work, scarcity of labour having interfered with the operations in the mine and mill. The amount of ore raised was 278,432 tons and, after removal of 13% waste, 242,000 tons went to the stamps. By amalgamation 43,857 oz. of gold was recovered, and by cyanide 21,423 oz., making a total yield of 65,280 oz., or 5.4 dwt. per ton milled, valued at £276,213, or 22s. 10d. per ton. The extraction was estimated at 87%. The revenue from all

the ore was £1,097,400, less the working cost of 19s. 8d. per ton milled, leaving a profit of £46,555, or 3s. 10d. per ton. Robert Pill, the manager, reports that the yield per ton is 3s. lower than during the previous year, owing to less ore being mined from the South Reef. This reef cannot be worked by machine drills, and extraction from it is dependent on the labour supply. Also a relatively larger amount of dump material and development ore was sent to the stamps. The cost of mining was increased by 6d. per ton, so that the profit was 3s. 6d. per ton less in 1910 than 1909. The labour difficulty is unfortunately not likely to be eased immediately, for the natives that are now coming to work are inexperienced and inefficient. As regards reserves, Mr. Pill estimates that on December 31 there was 1,124,631 tons of developed ore, averaging 5½ dwt., and 354,000 tons of probable ore. It is obvious that the labour problem dominates the situation.

TRADE NOTES

Most of the trade publications mentioned in this column are available for distribution and the manager of "The Mining Magazine" will be pleased to secure copies for persons interested.

F. W. Brackett & Co., Ltd., have sent us their bulletins describing Wet Vacuum Pumps for Cyanide Filters.

The British Humboldt Engineering Co., Ltd., have recently contracted with Messrs. Alexander Young (London) Ltd. for the installation of a magnetic separator plant to be erected in South Africa.

Allis Chalmers Co.'s London office report having received an order for a complete up-to-date all-sliming cyanide plant. This will be the largest and best equipped cyanide plant in Siberia.

The McKiernan-Terry Drill Co. have sent us their latest complete catalogue illustrating and describing the Terry Core Drill with the various appliances and equipments required for operation.

The New York Engineering Co. announce in their latest bulletin another improvement to the Empire drill. This comprises a spring winding device for hoisting drill-rods and insures greater speed in drilling and in moving the drill.

The British Aluminium Company have prepared for distribution a table showing standard sizes of aluminium cables in equivalents of copper cables, also a diagram showing minimum saving per mile in use of aluminium cables.

Sullivan Machinery Company announces in bulletin No. 60-G a Portable Rock Drill. The outfit is designed for special work, such as pipe trenches or ditch work. The drill is operated by steam generated by a vertical boiler, and the entire machine including boiler is mounted on a steel chassis.

The Wilfley Mining Machinery Company represent the American Spiral Pipe Works, manufacturers of spiral rivetted pipe and fittings. Catalogue No. 5 describes the diverse uses of spiral pipe, the tests made in the factory for strength, and also gives several valuable hydraulic tables. The catalogue is unusually well printed and useful.

The Sandycroft Foundry Co. have just issued their general mining machinery catalogue in Spanish. The entire 150 pages are devoted to illustrations and descriptions of every type of machinery likely to be used in mining or milling plants. The stamp-mill section goes into the details of mortar, guide, and tappet construction. The catalogue will prove most useful to engineers in Spanish-speaking countries.

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T. A. RICKARD, Editor.

EDGAR RICKARD, Business Manager.

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REVIEW OF MINING

THE MINING MARKET has shown a better tone, although no pronounced activity is evident. The Standard Oil decision stimulated Americans and the rumours concerning a copper merger helped the shares of mining companies producing that metal. Improved consumption of copper was also reported. Broken Hills and Russian issues have been cheerful. Mexican events adversely affected railway shares in that country, and mining indirectly. Kaffirs and Rhodesians have been dull, a few cheerful items of news being balanced by as many unpleasant incidents. The Central Mining meeting proved a temporary tonic to the Kaffir department. Meanwhile new issues have been made freely, although not many of them relate to mining. Some tin and oil flotations have been conspicuous. The last half of May was marked by a flood of prospectuses, threatening financial indigestion. Underwriters have been saddled with larger responsibilities than they bargained, yet prices have been well maintained. The general outlook is good and public confidence is strong.

TRANSVAAL.—The gold statistics for April were satisfactory, showing a yield of 667,714 ounces, worth £2,836,267, the daily average being 22,257 oz., which is a record. The aggregate for March was slightly bigger because that month contained one day more than April. For the first four months of 1911 the production has reached a total of £11,067,027, as compared with £10,207,951 during the corresponding period of 1910. Several mines exhibit a decreased output during April, but these were more than balanced by the increase of 10,158 oz. from the East Rand Proprietary. The average cost per ton was slightly lower and the average yield slightly higher, so that the profit

per ton (at 10s. 1d.) averaged 4 pence better than in March. As compared with a year ago, the yield is 6 pence less, the cost is the same, so that the profit is 6 pence less. Among mills not in operation in April 1910 are the Bantjes, City Deep, and Randfontein Central; on the other hand, the Meyer & Charlton, Vogel Deep, and Treasury are idle, although as regards the Meyer & Charlton the cause is known to be temporary. The labour figures also were encouraging, showing 194,328 natives employed on gold mines as against 183,814 in April last year. In a recent speech before the Transvaal Chamber of Mines, the President, Mr. H. O'K. Webber, stated that a diminution of natives coming to work was to be expected at this season, for several reasons. The importation of natives from tropical areas is prohibited from April to August. During the past eight months 19,433 labourers have been recruited in such regions. Therefore any additional supply for the present must come from British South Africa and Portuguese territory south of latitude 22°. On the other hand, the failure of the mealie crop, to which we referred in our last issue, will stimulate employment, so that it is expected that the number of natives on gold mines in October will be little, if at all, short of that recorded at the present time. Further, a real increase of machine-drilling is helping to make the supply more efficient; so that the only unfavourable economic feature is the continually increasing cost of native labour.

The seasonal migration of Kaffirs has begun and a decrease of 3915 natives is announced in the labour returns for May. Shortage of labour will, we fear, become acute between now and October. The output for May was a record, being 685,951 oz., worth £2,913,734.

The Brakpan mill made a crushing to test the machinery on May 23. Sixty stamps are now in operation. This marks the beginning of production by a company organized in 1903, so that 8 years have been required for development and equipment, entailing an expenditure of £786,000. On March 31 the reserve of ore was estimated at 1,913,000 tons averaging 6·6 dwt. per ton. When the entire mill of 160 stamps is at work it will have a capacity of 60,000 tons per month. This is a fine enterprise, wisely planned and carefully managed. The consulting engineer is Mr. W. L. Honnold, who is associated with the Consolidated Mines Selection Company.

Corrected estimates of the reserve in the Langlaagte give a life of 27 years, on the basis of 19,000,000 tons. This disposes of unfavourable rumours. It was also reported that the Randfontein Central was in need of funds and would issue its reserve shares. A fall in profits from the Van Ryn, the accident to the Driefontein crusher of the East Rand, and the Simmer East fiasco may be set against the excellent annual report issued by the City Deep; that complains of a lack of trained labour and of inadequate compressed air, but accentuates the splendid reserve of good-grade ore. Village Main Reef continues to prosper, the profits being increased without regard to less significant items.

Mr. George Albu, presiding at the General Mining & Finance Corporation's annual meeting, gave some interesting technical details, highly creditable to Messrs. E. Farrar, A. Heymann, and S. C. Thomson. At the West Rand Consolidated and the Roodepoort United the cost of milling is down to 2s. 6d. per ton; of the six mills in the Rand crushing over 10 tons per stamp, one half are under the control of this corporation. At the Roodepoort United the high stamp-duty of 20 tons daily has been maintained. Mr. Albu made an appeal for lower tariff duties and a revision of the railway rates, a reduction being essential

if the cost of living were to be brought to the reasonable standard required for economical industry in South Africa.

Referring to the transfer of Wernher-Beit holdings to the Rand Mines and Central Mining, it is interesting to note that these affiliated companies now control mines containing 35,000,000 tons of ore in reserve, out of a total of 81,000,000 in the mines of the Witwatersrand. These 81,000,000 tons represent about £110,000,000 worth of gold and are estimated to yield dividends to the extent of £30,000,000.

RHODESIA.—The Chamber of Mines gives the April output of gold as 52,546 oz., worth £221,296. This is 2520 oz., or £10,651, less than in March. In April 1909 the production was worth £228,213. Globe & Phoenix, the premier producer, yielded £41,050, as against £38,981 the month before. The Giant, Eldorado, Lonely, Penhalonga, Gaika, and Willoughby show no noteworthy change. The Wanderer gave £9009 as against £10,325 in March, and the Rezende £4968 against £5561. The shorter (30 days) month explains the slight decrease. The aggregate output for the first four months is £864,201, as against £887,997 during the corresponding period last year. Scarcity of labour remains a hindrance to further expansion of the industry.

The first annual report of the Shamva Mines is an interesting document, as it refers to one of the few big mineral discoveries of recent years. Results to date are highly creditable to Mr. H. A. Piper, consulting engineer to the controlling company, the Consolidated Gold Fields of South Africa. The test crushings have confirmed the accuracy of the early estimates and indicate that the ore is docile to metallurgical treatment. Above the first adit the ore blocked out in the Lone Star hill already amounts to 1,019,113 tons and when the workings on the second level have been completed, by the end of this year, the reserve will be enormously increased.

The ore is running the ore has been sold at half-penny (or 0'59d.) per ton and the assay-value is 3'72 dwt., after allowing for occasional high samples. The orebody is 1600 ft. long with an average width of 110 ft. for 920 feet. Mr. Piper estimates the working cost at 8s. 6d. per ton, provided the railway is extended to the mine. The ore is easily crushed, a trial having shown a duty of 30 tons per stamp. The second and third levels have been driven and so far the results have been encouraging, although the ore is not so wide and is also harder, owing to bars of quartzite. However, the favourable opinion formed last year has been generally confirmed. It is "a large low grade mine with enormous possibilities," some of which have already been subjected to proof, and most of which have already been discounted by the price of the shares.

The Cam & Motor, one of last year's issues, appears to be developing well. Owing to shortage of labour the work of exploration has been largely centred on one of three ore-bodies. About 400,000 tons of 11 dwt. ore has been opened up and a trial plant is being erected.

The Surprise has made a further contribution to *opera bouffe* mining, the April output of 567 oz. from 2432 tons of ore sending the shares below par as compared with £3 $\frac{3}{4}$ last year, when it was reported that the lost lode had been re-discovered. Some glowing cables were published at that time, followed by a long period of gloomy silence, culminating in another fiasco. No news concerning the two new shafts has been furnished for many months and shareholders generally have good cause to complain. The episode will not help Rhodesian mining.

The tin discovery in the Enterprise district has excited interest at Salisbury and Bulawayo, and has been followed by a rush of prospectors to the locality. So far only 'float' has been found and it remains to be proved whether these surface indications are connected with

an ore deposit of economic value.

WEST AFRICA. The situation of the Chamber of Mines appears to be suffering from the malaise that affects human energy on the Gold Coast, for the output for April had not been officially announced even at the end of May. Incomplete figures show that the four leading mines did about as usual. The Offin River dredges doubled their output in April as compared with March, while the Broomassie in May exhibited a healthy gain, yielding £9162 as against £7308 in April and £6630 in March. The gold comes from a number of small lenses of rich ore in the West 'reef,' the East lode having proved worthless.

The Ashanti Goldfields Corporation has issued a report by its consulting engineer, Mr. W. R. Feldtmann. This report is just what such a document ought to be; it is a simple and explicit description of the condition of the mine. It is no fault of the company or of the engineer if the report gives the impression that recent exploratory work has proved disappointing. In Justice's mine the ore-bodies appear to be irregular and detached. In the Ashanti some rich runs of ore have been found, but the ground is so patchy as to check cheerful estimates. Trouble with local fire-brick has interfered with the operation of the roasting furnaces. A shortage of labour underground is mentioned. On the whole, prospects are good but not unclouded. We note that Mr. Feldtmann succeeds Mr. G. A. Stockfeld as consulting engineer to the Taquah and Abosso mines.

The discrepancy between the information derived from bore-holes and the actual results of underground exploration in the Effuenta mine affords another example of the danger of treating cores as average samples of a lode. Unless the borings are numerous and systematically placed the inferences based upon them are apt to be painfully misleading, especially in deposits so variable as those in which gold is found.



TARKWA



MAIN SHAFT OF THE PRESTIA BLOCK A MINE

As a result of getting the first drilling at the Presta limited to a decline in the quotation. We understand that the power plant is not finished and that the mill is therefore hindered from working at full capacity. Otherwise all is well.

AUSTRALASIA. The Kalgoorlie mines are still under depression. Mr. Henri Kuss received no thanks from the Golden Horse-Shoe directors for his conservative estimate, but we note that he is being justified, for the yield in April was 31s. per ton as against the 34s. quoted by him; on the other hand the cost is 24s. as against the average of 25s. per ton estimated by him. The lower levels, from 1700 to 2000 ft., are not looking well, although prospects at an even greater depth have been improved by the evidence, furnished by diamond-drilling, that the Great Boulder main lode crosses into Golden Horse-Shoe ground. In the Ivanhoe the orebody appears to be lengthening at the 2270 ft. level, checking the diminution observed between 1620 and 2120 feet. The prospects of the Great Boulder depend largely on the finding of fresh orebodies in the eastern ground, that is, in the granite, which has not hitherto proved productive. The Perseverance may gain at the expense of the Associated, the tendency being for the orebodies to pitch westward. The Associated has finally selected a new manager to succeed Mr. George Roberts; he is Mr. Duncan F. Macaulay, formerly at the Perseverance and therefore well equipped with local experience. The Kalgurli has suffered from a diminishing output, but developments on the 16th level are said to be encouraging.

Great Fingall Consolidated may prove an example of correct geological diagnosis, for Mr. Malcolm Maclaren has expressed the view that the poor and broken condition of the vein below the 11th level indicates a fault or dislocation, the other portion of the orebody lying much deeper. Some evidence in support of this view has been obtained in the

winze sunk below the 14th level, for in a drift 190 ft. below the 17th level (2332 ft. on the lode or 2180 ft. vertical) about 300 feet of payable ore has been exposed, the average assay being 10 dwt. for a width of $6\frac{1}{2}$ ft. This two-compartment winze has been sunk 190 ft. below the 17th level, or a total depth of 784 ft. A new level is to be started at 160 ft. below the 17th. It appears that dark-blue quartz resembling that of the big orebody of the mine has been found, giving colour to the theory of a faulted structure. We hope further confirmation may follow. The Fingall orebody was at its best between the 6th and 9th level, where it averaged 14 ft. for a length of 1300 ft. This mine has now attained a vertical depth of 2300 feet.

Great Fitzroy is proving a sad disappointment. Smelting continues, but the oil concentration has been discontinued. Prospects are poor. At the Great Cobar conditions are far from satisfactory, and it is again rumoured that Mr. H. C. Bellinger will resign. It is the mining rather than the smelting that is at fault. The cart is sometimes placed before the horse. 'Great' is a dangerous prenomer for a mine.

North Broken Hill has declared a 2s. dividend with a 1s. bonus, as in February. This indicates prosperity. British Broken Hill has found 12 feet of high-grade ore in a drill-hole east on the 800-ft. level from Thompson's shaft.

The Waihi meeting was a friendly function and disarmed most of the critics. Since then water has been struck on the 10th level, hindering exploration. But this was expected, as was not the case with the demand made by the Miners' Union for $17\frac{1}{2}\%$ increase of wages and a modification of the contract system. Coming at this time this trouble is most unfortunate. The Waihi Grand Junction had a more cheerful gathering of shareholders, for the first dividend was declared and a deficit erased. Operating costs, exclusive of develop-

ment, have been decreased from 22s. 10d. in 1909 to 15s. 3d. in 1910. Mill treatment has been quickened and cheapened, while the ore reserve has been increased by 71,750 tons. As in the Waihi, the Martha lode has proved disappointing.

Telegraphic news comes of a new goldfield 100 miles south of Mt. Magnet in Western Australia. Rich ore is said to have been found.

INDIA.—We are informed that the Nundydroog Company has exercised its option on the South Jibutil property acquired two years ago from the Anantapur Gold Field, Limited. During this period much development work has been done. The latest report is that the lode is 3 ft. wide at the 550 ft. level, and pan-assays show the gold content to be equal to anything found in the upper workings. A subsidiary company is now in course of formation, and will be advertised at the end of the month; with the capital thus raised development work will be extended, and a treatment plant provided.

MEXICO.—Owing to anxiety caused by the decreased return for April, the directors of the Camp Bird have issued a circular explaining that the decrease was due to interruption of transport from the old mine in Colorado, owing to the railway being blocked by snow. Also the new mill of the Santa Gertrudis at Pachuca has not yet begun crushing. Such delays in the completion of a large plant are not unusual, and may be due in part to the interruption to traffic caused by the revolution in Mexico. The mill is now about to start and should be running at full capacity in August. In regard to the *aviado* shareholders, it appears that the purely nominal rights possessed by them are the subject of negotiation, as yet inconclusive. In any event, they do not constitute a menace.

The capture of Pachuca, in Hidalgo, by the revolutionists produced a change of local government, but did not affect the mines. The San Francisco del Oro, in Chihuahua, had to suspend milling operations, the interval

being used for alterations to the plant. At El Oro the followers of Madero made a threatening move but no harm resulted except a requisition (duly honoured) on the Dos Estrellas for 5000 pesos and 21 rifles. Our correspondent in Mexico City sends a detailed account of the effect of the revolution as regards the principal mining centres. Another correspondent contributes an interesting description of an episode in the revolution. In the meantime General Madero has entered the capital in triumph and the date of the general election has been fixed, so that we shall soon know whether the Republic is to be maintained or whether misrule is to prevail.

UNITED STATES.—Among the new and big copper producers is the Miami, milling having commenced in April. We are informed that the extraction is coming up to expectations; it is already 78%, and will shortly be 80%. The capacity of the mill will exceed estimates, being 3000 tons per day instead of 2000. The plant generally is superfine, being built throughout of steel and concrete; there is not a bit of wood in the mill except the launders. It is estimated that 20,000,000 tons of 2·7% ore is available. The enterprise does credit to Mr. J. Parke Channing, the consulting engineer.

The Ray Consolidated is now productive, making shipments of concentrate to the smelter at El Paso, pending the erection of its own smelter. The total ore developed and partly developed is estimated at 77,535,000 tons, of which 64,831,000 is assured, averaging 2·17% copper. Mr. Daniel C. Jackling is general manager.

The Utah Copper in 1910 produced 84,502,475 pounds of copper at a cost of 8·069 c. per lb.; this is equivalent to 37,724 long tons at £18. 3s. 4d. per ton. The reserve of ore is estimated at 203,500,000 tons of 1·67% copper ore, of which 152,130,000 tons is assured. The dividends amounted to \$4,648,676 for the year.

It is asserted at New York that the Rothschilds now control the Amalgamated Oil Company, thereby securing a footing in the United States, in competition with the Standard Oil. We learn also that the Gold Roads mine in Arizona has been purchased by the United States Smelting, Refining & Mining Co., on the initiative of Mr. A. F. Holden.

CANADA.—On May 23 it was reported that forest fires at Porcupine had damaged the Hollinger plant to the extent of \$125,000, necessitating a delay of three months. It was also rumoured that the Rea and Pearl Lake mines had suffered. Later cablegrams indicate that the compressor plant and mill at the Hollinger were saved, the loss being estimated at \$100,000. The mill is to be increased to 60 stamps. The railway to Porcupine is to be completed by July. The town is crowded with speculators and the price of everything, including mining claims, is high. Both of our correspondents at New York and Toronto send news concerning Porcupine.

SIBERIA.—The washing of the 571,908 cubic yards of gravel accumulated during winter has been commenced by the Lena Goldfields, the yield of gold so far reported from 15,905 cu. yd. being 6865 ounces. This is at the rate of 8'63 dwt. per yard, as against an average of 11'395 dwt. per yard for the whole of last season. Renewed activity is also reported by the Orsk Goldfields, the stacker-scow on the Kolchan placer having started to work on May 13, with an average yield of 1½ dwt. per cubic yard. This result is excellent, having regard to the difficulties created by partly frozen ground. The Troitzk, on the other hand, has had bad luck, through a fire that destroyed the buildings and plant at the main shaft. Six months are required for repairs and it is announced that further capital may have to be raised. According to the last report this mine had 38,000 tons of 7'8 dwt. ore available. The depth of the workings is 680 feet. At the Kyshtim the

smelting of copper is proceeding at the rate of 10 tons per day, the ore averaging 3'52%. Developments underground continue satisfactory.

VARIOUS.—Among gold mines in Central America that are noteworthy is the Aban-jarez, in Costa Rica. This mine is controlled by Mr. Minor C. Keith, of the United Fruit Co., New York, and is under the resident management of Mr. Percy L. Fearn. Production is now at the rate of \$105,000 per month, the output averaging 2500 to 3000 tons, some of which is specimen ore. A mill of 40 stamps, with two Gates tube-mills and a Butters filter plant, is in operation.

The Kano is a recent Nigerian tin flotation. Several of these have paid dividends, for the most part in scrip of new subsidiaries. The Northern Nigeria Mining & Exploration Co. announces an 80% dividend in cash on its first year's operations. Mr. H. B. Bateman has returned to the mine, for Pellew-Harvey & Co., the consulting engineers.

Speaking of tin, we note that the May output of the Tronoh constitutes a record, the production having been 482 tons of concentrate, 93% of it assaying 75'6% tin and the remainder 73%. The profit on the month's output is estimated at £38,252. The previous record in the Malay States was that of the Tambun, a private property owned by Towkay Leong Fee, with a month's production of 6500 piculs or 387 tons of tin concentrate.

The speculative controllers of the tin market have several times recently sold cash metal at over £230, but this sort of inflation of the price is not to the benefit of either producers or users.

The old Frontino & Bolivia, in Colombia, is raising fresh capital on a favourable report by Mr. F. K. Borrow, acting for Pellew-Harvey & Co. The New Chuquitambo is raising £50,000 for the development of its promising property in Peru.

STATISTICS

STOCKS OF COFFEE IN ENGLAND AND THE CONTINENT
Reported by Henry R. Merton & Co.

	March Tons	April 29 Tons	May 31. Tons
In England	64,251	61,563	57,557
In France	6,491	6,080	6,081
Afloat from Chile	3,825	2,925	2,200
Afloat from Australia	7,700	7,500	6,775
Total	82,267	78,068	72,613
In Rotterdam	7,300	7,100	7,250
In Hamburg (estimated)	10,000	9,800	10,500

AMERICAN COFFEE PRODUCERS' ASSOCIATION
In Tons of 2,240 lb.

	Produc- tion.	Deliveries			Stocks at end of month
		Domes- tic	Foreign	Total	
January 1911	51,650	18,785	23,753	42,538	63,591
February	49,030	22,553	20,139	42,692	69,929
March	58,273	29,500	26,375	55,875	72,325
April	52,716	33,396	27,736	61,132	73,909
May	56,670	28,814	27,669	56,483	74,105

PRODUCTION OF GOLD IN THE TRANSVAAL.

	Rand	Else- where	Total	Value
	Oz.	Oz.	Oz.	£
July 1910	610,664	28,050	638,714	2,713,083
August	623,129	26,140	649,269	2,757,919
September	621,311	25,588	646,899	2,747,853
October	627,445	25,702	653,147	2,774,390
November	617,905	24,686	642,591	2,774,390
December	616,668	24,327	640,995	2,722,775
Totals, 1910	7,228,588	305,532	7,534,120	32,002,912
January 1911	625,862	25,201	651,027	2,765,386
February	585,683	24,965	610,828	2,594,634
March	649,247	26,818	676,065	2,871,740
April	638,421	29,293	667,714	2,836,267
May	658,196	27,755	685,951	2,913,734

COST AND PROFIT ON THE RAND.

MONTH	Tons	Yield per ton	Costs per ton	Profit per ton	Total profit
		s. d.	s. d.	s. d.	£
October 1910	1,868,718	28 6	17 9	10 7	952,161
November	1,800,371	28 6	18 0	10 6	951,773
December	1,827,423	28 1	17 9	10 5	952,574
January 1911	1,865,232	28 0	17 11	10 1	930,059
February	1,712,198	28 6	18 3	9 9	874,612
March	1,960,678	27 7	17 11	9 9	949,415
April	1,926,583	27 7	17 6	10 1	971,858
Totals and averages for 1909	20,543,759	28 11	17 1	11 6	11,794,376
Ditto 1910	21,432,541	28 6	17 7	10 6	11,216,105

NATIVES EMPLOYED IN THE TRANSVAAL MINES.

	Gold mines	Coal mines	Diamond mines	Total
October 31	180,103	8,528	8,068	196,699
November 30	178,027	8,367	8,362	194,756
December 31	178,602	8,354	9,039	196,895
January 31	183,268	8,357	9,991	201,616
February 28	189,434	8,513	9,814	207,761
March 31	193,457	8,493	10,061	212,011
April 30	194,280	8,511	10,272	213,111
May 31	190,392	8,379	10,425	209,196

GOLD OUTPUT OF ENGLAND

Year 1909	Year 1910	May 1911	1911 to date
£2,083,901	£2,104,858	£177,147	£874,824

PRODUCTION OF GOLD IN RHODESIA.

MONTH	1908	1909	1910	1911
	£	£	£	£
January	199,388	204,666	227,511	207,903
February	191,635	192,497	203,888	203,055
March	200,615	202,157	228,385	231,947
April	212,935	222,700	228,213	221,296
May	223,867	225,032	224,888	
June	224,920	217,600	214,709	
July	228,151	225,234	195,233	
August	230,792	228,296	191,423	
September	204,262	213,249	178,950	
October	205,466	222,653	234,928	
November	196,668	236,307	240,573	
December	217,316	233,397	199,500	
Totals	2,526,007	2,623,788	2,568,201	

PRODUCTION OF GOLD IN WEST AFRICA.

MONTH.	1909		1910		1911	
	Oz.	Value	Oz.	Value	Oz.	Value
January	22,817	£91,112	17,357	70,699	15,903	£66,107
February	21,403	86,210	16,976	68,469	15,179	63,081
March	23,186	93,556	17,627	71,954	16,387	67,673
April	21,491	88,771	16,363	67,069		
May	25,104	100,056	16,590	68,355		
June	17,340	70,561	17,194	70,988		
July	17,771	70,773	15,564	58,551		
August	17,766	71,614	13,921	57,713		
September	18,125	72,963	11,497	47,746		
October	15,957	65,813	13,341	55,046		
November	17,882	73,824	14,021	57,658		
December	17,570	71,332	15,042	61,737		
Totals	335,972	955,635	185,493	755,985		

* Official figures for April unaccountably delayed.

PRODUCTION OF GOLD IN WESTERN AUSTRALIA.

MONTH	Export oz	Mint oz	Total oz	Total value £
For 1910	363,496	1,209,856	1,573,352	6,682,042
January 1911	17,463	102,035	119,498	507,592
February	22,047	84,991	107,038	454,666
March	12,296	93,267	105,563	448,426
April	20,455	91,791	112,246	476,787
May	22,076	88,952	111,028	471,615

OTHER AUSTRALASIAN GOLD PRODUCTION.

	1909	1910	May 1911	1911 to date
Queensland	190,468	189,777	114,700	485,400
New South Wales	300,460	314,777	305,580	1,320,827
New Zealand	300,000	189,000	140,280	629,280
Victoria	289,700	422,700	170,400	882,800

* April figures only.

SALE OF TIN CONCENTRATE AT REDRUTH TICKETINGS.

	Tons	Value	Average
April 28, 1911	904	£23,694	£26 s 4
May 5	685	£30,313	£44 11 9
May 15	145	£25,714	£176 11 9
May 20	11	£31,558	£286 4 9

EXPORTS OF TIN CONCENTRATE TO ENGLAND
Reported by A. Strauss & Co.

	April, 1911 tons	May, 1911 tons	1911 to date tons
Metal from Straits to Europe and America	3,115	4200	20,502
Metallic Content from Bolivia to Europe	1,552	1657	8617

EDITORIAL

WE take pleasure in stating that Mr. George Safford, lately business manager of *The Mining Journal*, has joined the staff of this Magazine.

THE NEW quarters of the Mining and Metallurgical Club at No. 3 London Wall Buildings will be opened for members on Tuesday, June 27. Luncheon and dinner will be served from that day forward. The decorations have been completed, and the furnishing is well in hand, assuring a convenient and delightful rendezvous for the profession in the heart of the City.

FOREIGN CAPITAL invested in Mexico is estimated at about £400,000,000. Of this grand total about one half has been provided by the United States, 35% of her investment being in railways and 45% in mining. British and Canadian capital in Mexico aggregates about £140,000,000, of which 60% is in railways, 15% in mining, and 25% in agricultural or other industries. The French, German, Belgian, Dutch, and Spanish contributions make about £60,000,000, placed mainly in banks, manufactures, and trade. Thus the foreign capital involved in Mexican mines at the present time reaches the large sum of £110,000,000. This is a conservative estimate.

RESPONSIBILITY—or irresponsibility—of directors was involved in the questions put to the Under-Secretary for War in regard to the appointment of Colonel Morgan. It appears that he holds many directorships, but the duties incidental thereto are held not to interfere with his work as a public servant, at least the retention of them is deemed “consistent with the placing of his whole time at

the disposal of the War Office.” This will not astonish our readers, but it points a scornful finger at the casual manner in which men undertake to act as trustees for shareholders. We hope the day will come when directors will be chosen from among these specially qualified, who will make a profession of such work, and will be prepared to give adequate time and attention to their duties.

OUR neighbour *The Financial Times* publishes a monthly list of mining returns, giving a mass of information conveniently arranged. We note that this record suffers from the various units employed by the different companies. Some give their results in ounces, some in profit, some in revenue, some in pounds and others in dollars, most in fine gold but a few in bullion. It is high time that the mining companies adopted a uniform practice, and there is only one that ought to be followed, namely, the giving of the amount of money available for dividends. Ounces of gold mean nothing unless you know the deduction to be made for working cost; even revenue is vague unless it is stated what expenses are deductible; statements in bullion are silly. Even a profit from which taxes, directors’ fees, and London expenses have not been subtracted, is misleading. The shareholder wants to know the result of the monthly output in terms of pounds sterling available for dividends. Anything else is confusing and misleading.

A CASE that came recently before the City of London Court goes to prove the value of the luminous tail as a financial bait and the farcical employment of such suffixes as F.R.G.S. and M.I.M.E. The defendant, knowing nothing about china clay, had put his name to a report dealing with that

mineral, the report had been written by the plaintiff, who paid the defendant £2 to sign it. The only reason for using his name was the fact that "he could put F.R.G.S. after it, and that had a bit of value on a company report." So says the account published in the daily Press. The plaintiff acknowledged that "to write F.R.G.S. was not of much value now on a company prospectus." Anyone who could sign M.I.M.E. would have answered the purpose better. We are glad to see this exposure and we hope to see the day when the use of F.R.G.S. and other irrelevant initials will be recognized as an attempted imposture.

MALARIA is the scourge of the tropics and it is one that falls heavily on those engaged in mineral exploration, especially in coastal regions of low altitude. Until comparatively recently the cause of the disease was unknown and preventive measures were ineffective. Among those to whom mankind is indebted for light on this vital subject is Major Ronald Ross, whose book on 'The Prevention of Malaria' ought to be in the library of every mining company. It was in 1640 that quinine, the bark of the cinchona, was introduced into Europe by the Contessa d'el Cinchon, wife of the viceroy of Peru, who had been cured by means of the drug. In 1894 Ross discovered the malaria parasite in a peculiar variety of mosquito, the Anopheline, and proved that the infection was carried from man to man by this insect. These two events were of momentous importance to mankind and represent the two principal steps toward the amelioration of life in the tropics. Now we know that protection by netting, destruction of the mosquito by the use of oil and drainage, and preventive treatment by quinine are the three methods for overcoming a natural pest. Much work remains to be done. It has even been suggested that King Edward be memorialized by raising a fund for the

better protection of human life in the tropics. Assuredly an organized effort to eradicate malaria in British territory would be more worthy of the royal memory than the erection of one more of the ugly statues that disfigure London.

COMPANY meetings afford suggestive commentary on the ways of those engaged in mining. We refer to the Waihi meeting elsewhere. Two points call for further comment. The power of the Press was fittingly recognized by numerous references in the Chairman's speech. He gave a perfumed compliment to *The Economist* and he protested vigorously against misrepresentation on the part of *The Times*. Other journals came in for less direct mention, but the inference was that public opinion sways to public criticism. Indeed we believe that fair criticism from the technical and financial Press is more effective than the splutters of those who interrupt the congratulatory proceedings of annual company meetings. Another interesting feature lay in the appreciation of the audience to the good and bad points of the Chairman's speech. Its only weak spot was the bathos about "the buzzing of human horseflies." This evoked no endorsement, only laughter. But his remarks on speculators and investors were as witty as they were discriminating. They were received with laughter of a more sympathetic character. We are glad to see so keen an appreciation of the status of the investor, as against the speculator, and we commend the obvious effort to run mines in the interest neither of the punter nor of posterity.

OUR CONTEMPORARY, *The Investor's Chronicle*, an excellent financial review, publishes an initialled article on the Hollinger mines, at Porcupine. In this article we find the following paragraph: "As evidence of permanency it may be noted that on the adjacent Dome mine, which is putting up a

100-stamp mill and cyanide works, a bore has cut the deposit at 400 ft., giving 'highly payable' results. To throw further light upon this all-important point, Dr. Maclaren is to make a geological survey." We quote at length because this paragraph affords illustration of most of the errors it is possible to make in writing on the subject. In the first place, an ore deposit is 'permanent' only on the supposition that it is not exploited; when it is mined it ceases to be permanent; it vanishes in the capacious maw of the stamp-mill. The erection of a 100-stamp mill is presumptive evidence of impermanency. The writer means 'persistent' or 'continuous;' he ought to say so. Next, the cutting of ore by a diamond-drill gives no assurance of "highly payable" results. A core is a most unreliable sample and as such is deemed untrustworthy evidence by experienced men. Drilling may prove the continuity of an orebody; it does not prove its average contents. Finally, a geologist, even so good a geologist as Mr. Malcolm Maclaren, cannot throw light on the "payable," meaning 'profitable,' character of an orebody; that is done by a mining engineer versed in such matters, more particularly by means of careful sampling underground and correct inferences therefrom. Mr. Maclaren's geological survey will give information concerning the structural geology of the district and will furnish guidance for prospecting, but it will not help anyone, in London or Canada, in appraising the value of the ore in a particular mine, however much it may elucidate the possibilities of finding more ore.

WITHIN twelve months the world has lost two famous exponents of the lighter vein in literature and philosophy; one, Mark Twain, a typical self-made American, who will be remembered for his racy accounts of life in the middle and western States; the other, W. S. Gilbert, a characteristic Englishman born in London of an old Devonshire

family, educated for both the Army and the Bar, the possessor of a cultured fancy, and a master of precise diction. Primarily the universal popularity of these two writers was due to the fact that their humour had no flavour of the smoking-room, but beyond this they had nothing in common. It is not our intention to discuss their humour, to recapitulate the services rendered by both to mankind, or to describe the financial successes achieved by them, for to these features the English and American Press has already done ample justice. We venture, however, to lay stress on a feature of Gilbert's work that bears directly on a subject of intimate interest to us, namely, his precision of language and polished style. No writer ever studied his words and phrases more carefully than Gilbert; every word had its use and object, and the meaning was invariably clear, although the subjects, the ideas, and the views expressed were apt to be unexpected and surprising. The actor or singer who spoke or sang them was not allowed to deviate by a hair's breadth from the book. His poetry is conspicuously free from clumsy rhyme and halting metre, from repetition, extraneous ideas, or circuitous verbiage merely introduced to complete a line or a verse. Thoughtless people have sometimes said that his operas owed their success to the rare advantage derived from the association with a tuneful musician, but Sullivan would not allow this view to go uncontradicted and generously admitted that it was easy to write attractive music to such lilting lines. To those who wish to cultivate conciseness, accuracy, and clearness of style we can recommend a careful study of his methods. Gilbert's verses are accepted by Professors of Poetry as the standard of metrical composition, and the oftener they are read the more their structural beauty is appreciated. Would that some of our technical men were as careful in the choice of their words as the dead humourist! From our own point of view we

are free to confess that his writings, either in prose or poetry, have a soothing effect when we are suffering from the mental dyspepsia induced by editing the articles or reports of the casual scribe.

OWING TO the size of the country and the incompleteness of its system of transport, the news received from Mexico is often contradictory. Most of it relates only to the border States, where the American reporter is rampant. But it is in the South that the true nature of the revolt against the Diaz regime is least obscured by mere filibustering. Yet even those who live in Mexico appear to have meagre notions of the condition of affairs. Being in the heart of the forest, as it were, they can hardly see how big it is or how it varies in parts. Thus one of our readers, a mining engineer, just returned from Mexico, writes to protest that the general tone of our comment recently has been "unduly serious," and he proceeds to inform us that "there has not been up to the present, and there is not now, a revolution in Mexico." Well, is it a garden party? When the troops of a Government are defeated by citizens in arms, and when the head of that Government first resigns and then flees from a country, it is usually said, for the sake of brevity, to have undergone a 'revolution.' Fortunately for our correspondent his letter arrived just too late for publication in our last issue. To him Madero is merely an adventurer, the fuss is of American manufacture, the disorder is confined to the "all but inaccessible mountains," and Mexico is in a condition of orderly well-being. Finally, he says that "life is as safe (and property, I think, safer) than it is in England to-day. Diaz "at all times has been a patriot, which, with a smug traitor for our Prime Minister, might give us to think." Again we say that it is fortunate for our correspondent that his letter was spared from publication. Yet he concludes with the reflec-

tion that "the general ignorance of the British people as to the vast territory of Old Mexico is profound"—not half as profound as the complacency of a reactionary nor nearly as vast as the ignorance of a man who habitually shuts his eyes to the progress of human events.

WE HAVE HAD occasion more than once to object to the varying, and consequently misleading, way in which the cost of mining is stated in company reports. Thus the chairman of the Waihi Grand Junction was able to give an excellent account of the past year's operations and to point with pride to the low cost attained, namely, 15s. 3d. per ton as against 22s. 6d. in 1907. This is to be credited largely to the new manager, Mr. W. Frank Grace. Yet we hold that the chairman's statement suffered by not being beyond the chance of misunderstanding, for the figures quoted do not include charges for development. This, frankly, is absurd. One might as well give the cost of farming without giving the expense of ploughing. The only way to be perfectly explicit is to give the total amount of money to be deducted from the profit available for dividends. To a shareholder it matters not whether the money deducted from his ultimate receipts in the form of dividends is spent on candles or on entertainment of directors, on fuse or on postage stamps. As a check on the resident management and a measure of the manager's ability it may be well enough occasionally to give the operating cost separately from London expenses, but when this is done it should be stated so that it is understood beyond peradventure, and to it ought to be tacked the estimated expenditure per ton incurred at the London office or in transit. Thus Rhodesian companies often give figures that are painfully misleading, for after the cost of mining and milling has been ascertained, it remains to add expenditures under such diverse headings as development, shaft-sinking, bullion

charges, Government royalty, depreciation, London office, directors' percentage, directors' fees, and so forth. The three significant items are the total yield per ton, the total cost per ton, and the final profit available for dividends. The last of these expresses the ultimate purpose of mining operations.

IN THE annual report of Rand Mines we note a kindly reference to the resignation of the general manager, Mr. George E. Webber. This is an event calling for more than casual comment in this Magazine, for Mr. Webber is a notable figure and has played an honourably prominent part in the development of the great industry that has made the Transvaal. He represents the old school. For 21 years he worked for Mr. James B. Haggin when Haggin & Hearst were big mine operators in Western America. Thus he was connected with the Homestake and other famous mines. Leaving them he went to El Callao when Mr. Henry C. Perkins wanted a first-class manager at that famous old bonanza in Venezuela. From there he went to Johannesburg to manage the Crown Reef mine, now a minor part of the consolidation known as the Crown Mines. Later he succeeded his old chief, Mr. Perkins, as general manager for the Rand Mines, retaining the appointment for 15 years. Thus he played a large part in modern mining. He was, and is, the type of sound and capable mine executive, so much needed when the industry of the Rand expanded to great proportions. Personally, he was widely respected as a man and highly regarded as an administrator. Although not technically educated in the modern way he was able to write reports that were models of conciseness and intelligence; indeed he was conspicuous in the possession of judgment and good sense, that is, the very qualities that no school of mines can give and that are yet so essential to the purpose of mining, namely, the

profitable exploitation of mineral deposits, not of simpletons. We unite with his many friends in wishing Mr. Webber happiness and health in his retirement from active duty.

Russian Mining.

The use of British money for mining enterprises in Russia, and notably in Siberia, has been stimulated lately by some notable successes. These have not been achieved without persistent hard work, in strong contrast to the reckless company-mongering that created the premature boom of 1906. For example, five years ago the shares of the Siberian Proprietary Mines, by the use of the names of Lords Derby and Knollys as directors, and by aid of a campaign of irresponsible spoofery, rose to £17, when they were not worth as many shillings. Other shares of that group were kited to prices that now seem ridiculous, and it is a marvel that public confidence was not entirely withdrawn from the business of Russian mining. However, among the undertakings then started were one or two of real merit, notably the Spassky copper mine. The others have gone the way of liquidation. To the robust survivors have been added some newer ventures of unquestioned merit, to which the support of speculators both at St. Petersburg and Paris has been given so freely as to cause a notable revival in what may now be called the Russian department.

The Siberian Syndicate was founded in 1902 on some options that were rejected, but the investigation incidental thereto led to the acquisition of the Spassky mine, which was financed by L. Ehrlich & Co. with whom a French group, headed by Mr. Ernest S. Carnot, has co-operated throughout. Messrs. W. Pellew-Harvey and E. Nelson Fell were the examining engineers. The Spassky Copper Mine, Ltd., was issued in 1904. The Atbasar, another subsidiary of the Siberian Syndicate, was registered in 1906. The Atbasar Copper Fields controls a mineral area of

12,000 acres in the Kirghiz steppes, in the Akmolinsk province of Siberia. Its original capital was exhausted two years after the start in 1906 and more money was then furnished by an Anglo-American group on a favourable report by Mr. H. A. Titcomb. They bought 60,000 shares with an option on 250,000 more. These rights were acquired by the Spassky a few days ago. Thus the Spassky obtained a controlling interest in the Atbasar. Mr. Arthur Fell is chairman of all three companies, the controlling interest being L. Ehrlich & Co. acting under the advice of Mr. E. T. McCarthy.

Among those connected with the incubation of the Siberian Syndicate was Mr. Heyman Orkin, who organized the Siberian Proprietary Mines in 1905 for the purpose of acquiring some options, since abandoned, from another company, now defunct, called Siberian Exploration. In 1906 the Siberian Proprietary hatched the Orsk Goldfields, Troitzk Goldfields, and Kluchi Gold Mines. Mr. J. C. Williamson is chairman, and Hooper, Speak, and Feilding are now the consulting engineers to the parent company and its subsidiaries. Of these the Orsk Goldfields was registered with a view to acquiring a lease in the Orsk district of the Southern Ural, but the lease was abandoned and in 1909 attention was transferred to the Nadetsky property, covering 6700 acres of gold-bearing gravel near Nikolaievsk in Eastern Siberia. This lease was obtained through the Russian Mining Corporation, which received £30,000 in fully paid ordinary shares, out of the total capital of £920,000 in priority, preference, and ordinary shares. A stacker-scow is now in operation, and a large dredge is in course of erection. The ground has been sampled and tested by Messrs. C. W. Purington and D'Arcy Weatherbe. A handsome margin of profit seems to be assured, but delays and preliminary expenses have both been in excess of the estimate, so that the patience of shareholders has been sorely tried. The Troitzk is opera-

ting gold mines in the Kotchkar district of southeastern Russia. Productive operations with a new plant has been in progress since September 1909; but the margin of profit is small. The capital is £600,000 and mortgages for £52,621 are held by the Siberian Proprietary. The Kluchi mine is in the Nerchinsk district, Eastern Siberia, and was formerly owned by the Nerchinsk Gold Co. The authorized capital is £338,858. Work has been suspended. The ore is low-grade and refractory. Like the other members of the group this company has several classes of shares, so that the capitalization is complicated, but it suffices to say that none of them has any market value at the present time.

The Russian Mining Corporation was organized in 1906 on the initiative of Mr. F. W. Baker. In 1908 the corporation promoted the Lena Goldfields, whereby it has profited handsomely. On its issued capital of £41,250 it paid £75,000 to its shareholders. In January 1911 the corporation was reconstructed with a capital of £225,000. The controlling interests of the Consolidated Gold Fields of South Africa and of the Hirsch Syndicate are suggested by the fact that Messrs. E. Birkenruth and F. W. Baker are directors. The Lena Goldfields has the same chairman as the Russian Mining Corporation, namely, M. Basile de Timiriazeff; the Consolidated Gold Fields being represented by Lord Harris as vice-chairman. Registered in 1908, the Lena company acquired 70% of the issued capital (11,100,000 roubles) of the Lenskoie, a Russian industrial corporation. The consideration was £728,220 in £1 shares, of which the Russian Mining Corporation received 60,000 shares. The alluvial gold mines of the Lena are in the Irkutsk province of Siberia and have been worked since 1863. This enterprise has proved a splendid success, the profit for 1910 being £600,000. The shares have risen recently to £6 on speculative purchases at St. Petersburg. At the present time the

Russian Mining Corporation, in addition to its holdings in Lena and Chuk Goldfields, has an option on a valuable copper property, called the Syssert, in the Ural region and near the Kyshtim. An inspection is being made by Mr. C. M. Rolker, who is consulting engineer both to the Hirsch Syndicate and to the Lena Goldfields.

The Kyshtim Corporation (1908) was a promotion of the Perm Corporation (1907), itself a child under the joint parentage of the Anglo-Siberian Co. (1906) and the East Russian Mines. By an exchange the Anglo-Siberian Co. obtained 248,898 shares of the Perm Corporation and 38,724 shares of the Kyshtim. At the date of the last annual meeting the Anglo-Siberian had £110,000 cash and 516,733 Kyshtim shares, of which 232,000 were under option, partly exercised since then, 141,733 were reserved for debenture conversion, and 142,500 were free shares. Thus its total assets were £788,750. The Kyshtim Corporation has a capital of £1,000,000 in £1 shares, of which the Perm Corporation obtained, as promoter, 125,000 fully paid shares. In addition 6% debentures for £400,000 have been issued, of which £300,000 are convertible into shares at 30s. Mr. T. Blair Reynolds is chairman of the Anglo-Siberian Syndicate and a director of the Kyshtim. Mr. C. F. H. Leslie is chairman of the latter. A large interest is held by Messrs. H. C. Hoover and A. C. Beatty, who recently assisted the company financially to enable the erection of a smelter. In a report made last December the consulting engineer, Mr. R. Gilman Brown, estimated the profit for 1911 at £295,000 on copper operations alone, not including the trading profits on timber, firewood, and iron ore. Since then these estimates have been fully realized, the output for the first quarter of 1911 being 49,272 tons of ore yielding copper, gold, and silver worth £102,902.

Thus it will be seen that the four first-class enterprises and the two doubtful ones now

surviving are related to one another in various ways, serving to remind us of their parentage, which in some cases was illegitimate. However, they should be judged not by their antecedents but by their performance. We recognize with pleasure that several of them are now in the hands of managements able, both from a financial and a technical standpoint, to give shareholders faithful and efficient service. The outlook for Anglo-Russian enterprise is excellent. We hope that advantage will be taken of this favourable time to secure such co-operative action as may serve to remove several anomalies that handicap mining in Siberia. The future participation of British and American operators can be encouraged by the Russian government giving increased facilities for economical exploitation, especially as regards labour and transport.

Porcupine.

In the course of enquiries concerning this goldfield we have received letters from two mining engineers of the highest character, both of whom have recently been on the spot and are in a position to express trustworthy opinions. For reasons that need no apology these gentlemen decline to publish anything over their signatures, but they are desirous of correcting erroneous impressions. One of them emphasizes the fact that not the silver mines of Cobalt but the copper and nickel mines of Sudbury today constitute the dominant factor of the mining industry of Ontario. Cobalt is a new and spectacular addition, identified with intense public participation, while Sudbury, having passed under the control of the nickel trust, has escaped the limelight. However, that is a minor point. Porcupine now holds the centre of the stage as against both Cobalt and Sudbury. It is hoped that the new goldfield will be a credit to Ontario, and it is feared that it may not, if ill-regulated optimism is expressed in terms of wild-cats. So far the amount of mining done

is out of proportion to the quantity of excitement provoked. On the Dome, Hollinger, and Rea some serious development has been accomplished; on the Vipond and Scottish Ontario a beginning has been made. On other claims a few pits have been sunk and the surface stripped, but shafts as much as a hundred feet deep are scarce. One of our informants asserts that the Hollinger has some $2\frac{1}{2}$ oz. ore, but no large tonnage of such high-grade stuff; as regards the Dome he insists that calculations of the management are based on 10 dwt. ore, with not more than enough of it blocked out to repay the capital invested. Several promising prospects exist, but as yet they are far from having reached such a stage of development as to be labelled "highly profitable" mines. On the other hand, another informant writes to say that he was well impressed by the Hollinger and the Dome, and considers the Rea and Foster to be good 'prospects.' Many of the lodes are lenticular in form, parallel to the enclosing schist, but the lenses recur so frequently that, in several instances, as in the Hollinger, they constitute one continuous ore body. In some of the smaller veins, such as the Vipond, the ore is only two feet wide, narrowing to six inches, but showing free gold, while in other cases the ore is from 3 to 15 feet wide, expanding in places into large outcrops, as at the Dome, with its 60 feet of almost unbroken quartz. Some of these quartz outcrops are so poor as to be valueless; the prospector sees the ore that carries visible gold and fails to check his inferences by sampling. Indeed, systematic sampling has been performed only in two or three instances. The Dome has been blocked out thoroughly and sampled carefully, with results justifying the erection of a 40-stamp mill, designed by Mr. C. W. Merrill. Good prospects are scarce and good mines will be rare at Porcupine, as in most mining districts. The showing of native gold at the surface has been employed recklessly to exploit the

Toronto share-market and will prove disappointing in many cases, as free gold showings generally do. The persistence of ore in depth has yet to be proved. Besides letters from the two engineers mentioned we have read the careful article by Mr. Reginald E. Hore in the *Mining and Scientific Press* of April 23, an abstract of which appears in our *Précis of Technology*. This gives technical data concerning the petrographic features of the Porcupine veins and suggests their resemblance to those of California. The prevailing rocks belong to the Keewatin formation, a fact that should remind us of the boom that brought the Lake of the Woods into prominence in 1897. Since then Cobalt has redressed the balance of failure that followed that earlier outbreak of optimism, but no harm will be done by recalling an experience that should point a warning finger at reckless speculation.

Exit Diaz.

On May 25 Porfirio Diaz resigned as President of the Mexican republic, his place being taken automatically by the Minister for Foreign Affairs, Señor De la Barra, who, as Provisional President, will remain at the head of the Government until a general election can be held. Thus a great career comes to an end. The old dictator was finally driven from power by a mob, for it was the rioting in Mexico City itself that impelled him to hasten the abdication previously promised. Suffering from an ulcerated jaw and weary with his 81 years, the strong man of Mexico had to yield to popular clamour and fled to Vera Cruz, there to take ship for Europe. It was a pity he could not have resigned with dignity, instead of playing a pathetic part in the conventional *opera bouffe* of a Central American revolution. But the finish was not inappropriate, for his rule bore no likeness to representative government and was terminated by forces at least as enlightened as those that gave it birth. A soldier who was half a ban-

General Diaz broke his parole, a politician who conspired against successive governments, in short, a reckless adventurer, Diaz rose on the ruins of Maximilian's brief empire, and amid the disorder that ensued, to a position of uncontrolled power. In 1877 he became—it would be farcical to say that he was "elected"—President. In 1880 his first term expired and his Secretary for War was nominally at the head of the Government; but Diaz remained the dominant spirit. In 1884 he was re-elected President, and the law as regards a successive term having been abrogated, he remained at the head of the Mexican Government until a few days ago. In July 1910 he was "re-elected" for the eighth time. Of course, he was not elected. The election was a sham, and the fact that it was such became one of the reasons impelling the revolution of Francisco I. Madero, who was one of the unsuccessful candidates. Now the tables have been turned. It remains to be seen whether the forthcoming election is conducted in the interest of representative government or whether Mexico has merely changed one autocratic regime for another.

With General Diaz has gone the vice-president, Señor Ramon Corral, and a more useful man, Señor José Y. Limantour, whose name is identified with the financial integrity of Mexico. Another result of the revolution will be to drive Señor Henry Clay Cree! from power in Chihuahua, and with him General Luis Terrazas, together with other financial exploiters and territorial magnates. It is popular hatred of these that incited the recent outbreaks. Nearly every State has its own grievances, which in most cases have been appropriately personified by its Governor, a despotic satrap veneered with American graft. A corrupt judiciary supported by an army of uniformed brigands; peonage or forced labour, supplemented by an unregulated factory system; a centralized government run in the interest of foreign syndicates; these have been

the mainsprings of political unrest. If the unrest has not come to a head before it is because a strong man was at the helm and back of him was the influence of the group of capitalists and promoters to whose enterprise the recent industrial progress of Mexico is due. But the country has been continually disquieted; in various localities at different times an effort has been made to protest against some unusually tyrannical or predatory act of the ruling power, masquerading in the guise of a Republican institution. These little affairs have been ruthlessly squelched and the news of them did not travel far. Even now the opposition to the government of Diaz is represented by detached bands of insurrectos slow to unite for collective and systematic action. The task of General Madero is difficult. As *The Times* correspondent at Washington says: "He has undoubtedly proved himself more than a picturesque dreamer, but the test of statesmanship has yet to come." The war has cost \$20,000,000 and damages to foreigners are estimated at \$2,000,000. But this does not measure the loss incidental to the break-down of the Diaz regime, for cruelties and pillage have done incalculable injury to individuals and to the prestige of the country itself. The daily Press has published full accounts of the theatrical affairs at Agua Prieta and Juarez, but only private letters relate the many murders and assassinations incidental to the savagery and brigandage that have marked the recent outbreak against the Government. Unfortunately the veneer of civilization is thin and it has required an iron hand to lay it on a people most of whom are without education. Diaz and his friends have given Mexico an era of extraordinary industrial expansion, but the real basis of national character has been left untouched. The people of Mexico may be too advanced for a military autocracy but they are hardly ready for representative government. There lies the danger. In default of absolutism on

the one hand or of real republicanism on the other, they will have to fall back on the compromise of a bureaucratic system checked by an occasional election based on a narrow franchise. This is but a precarious method, but it is all that is available just now. However, the leaders of the revolution, which may pre-empt a reformation, have the good wishes of those, and they are many, to whom Mexico has ever been a land of rare charm and interest. They have a great opportunity, in no way spoiled by foreign interference. Indeed, a striking feature of the episode has been the persistent desire of foreign governments to abstain from complicating the position of both parties in Mexico. For this the government at Washington is particularly to be complimented. Mexico may not be politically mature, but she is out of the nursery and can manage her own affairs. We trust she may show signs of the self-control of manhood.

Balcobo.

The prospectus of the Balcobo Tin Mines appeared in the daily Press when our May issue was in the printer's hands, therefore we were unable to comment upon it before the subscription list had been closed. This we do not regret for it is no part of our business to influence the subscription of capital to specific issues, it is our purpose rather to create a healthy public opinion on matters of mining finance. If we are compelled to criticize destructively some of the fiscal efforts of the promoter it is in sadness rather than in malice and as a text for general observations rather than with the intention of spoiling the plans of the enterprising financier. The Balcobo, for example, is a company formed to exploit tin mines in Spain. The directors are four in number but not one of them appears to have any such knowledge of mining as would render him desirable in an administrative capacity. We deprecate especially the use of the name of the ex-Premier of Western Australia. No

reason exists for believing that Premiers are specially qualified to direct a mining enterprise. Those of Western Australia appear to have a regrettable habit of posing as authorities on matters on which their opinions are valueless. The opinion on a mine of a Premier, a General, an Admiral, or an Archbishop is not worth as much as that of a mining engineer. This is an elementary truism, but it needs to be reiterated. The Balcobo, however, sets a good example in having a consulting engineer, although the gentleman whose name adorns the prospectus appears to have no recognized professional standing as a mining engineer, for he is not a member of the Institution of Mining and Metallurgy. One of the reports on the mine is by an engineer who carries the suffix A.M.I.C.E., which is of no consequence, for an Associate Member of the Institution of Civil Engineers need not have had any experience in mining. Another report is by a chief engineer in the Department of Mines to the French Government and a Member of the Conseil du Réseau des Chemins de Fer de l'Etat; this also is magnificent, but not business. No special aptitude for examining a tin mine in Spain is herein indicated. The flowers that bloom in the spring have as much to do with the case. Finally, the company's consulting engineer has made a report, from which extracts are quoted. These are enough. On the basis of irregular and shallow workings in the top of a hill of so-called 'pegmatite,' which is kaolinized granite, it is assumed, by multiplying maximum dimensions by difference of altitude, that 2,000,000 tons of ore are available. As if to give an air of vraisemblance to an unconvincing estimate, we are told that the tonnage is decreased to 1,750,000 "after allowing for moisture and crevices." On the other hand the other two engineers estimate the ore assured at 3,000,000 tons. Profits on an output of 750 tons of fine tin are forecasted at £93,900 with the market price of the metal at £170,

which appears to be the most conservative figure in the entire calculation. Reference is made to Mount Bischoff, which is not even spelled correctly, as "an example of what can be done with efficient management." To which we have only to remark that Mount Bischoff's early success was not due conspicuously to good management but to an enormous mass of rich ore in easily accessible form and that even the most efficient management cannot atone for errors of estimate or the assumption that rock is ore. As a matter of fact the Balcobo deposits have been examined by engineers far better qualified than those whose names appear in the prospectus. Their sampling showed that the mass of 'pegmatite,' or kaolinized granite, is unlikely to give an average yield of anything like 1% metallic tin. The veins in the schist and granite occur in pipes or vertical shoots separated by sterile rock; the old workings are so irregular and inaccessible as to vitiate any accurate estimate; finally, several veins afford promising prospects worthy of trial but inadequate for regular production; in short, while the tin deposits are such as to justify a private syndicate in further investigation and development, they are not such as to warrant an appeal to public participation on the evidence afforded by the prospectus.

Standard Oil.

On May 15 the Supreme Court of the United States gave its decision in the case against the Standard Oil Company, confirming the decree of the lower Court. The suit in question was instituted by the Government in 1906, the immediate object being the dissolution of the Oil Trust as organized in the name of the Standard Oil Company of New Jersey. Thus the Sherman Act, for the regulation of inter-State commerce, was put to the test. This law was enacted in 1890, becoming the basis for a number of suits, most of which resulted in decisions that were futile.

The Circuit Court of Eastern Missouri, before which the Standard Oil case first came for trial, found that the reorganization of the Company in 1899 was both a conspiracy in restraint of trade and an illegal monopoly. The Court decreed that the combination must be dissolved within 30 days. On appeal to the Supreme Court the case was argued at great length in March 1910 and in January 1911, ending in a final decision affirming the decree of the lower Court, dissolving the Company, but giving it six months to comply with the law. By this latest decision the legislation against trusts is strengthened, it being interpreted that the words "restraint of trade" in the statute are to be construed in "the light of reason." Whether laws are habitually interpreted in the darkness of unreason, it is not for us to say; it is obvious that until now the Sherman Act has not fulfilled the purpose intended. If the Supreme Court's decision is not evaded and if the commercial tyranny of the Standard Oil is thereby broken, a great service will have been rendered. In any event the decision is a finger post pointing to dangers that have threatened to undermine representative government in the United States. For the Standard Oil has been, and is yet, not only a monopoly, a conspiracy to kill competition, and an organization to subvert the law, it has been the nucleus of a systematic effort to apply strategic wealth to the destruction of representative government in the United States. Born in iniquity, cradled in infamy, this band of industrial pirates has won power by bribing railroads, corrupting legislatures, and poisoning the commercial life of an entire continent, with agencies that extended its evil activity to the remotest parts of the earth. No more powerful corporation has existed. From 1882 to 1907 the profits are estimated to have been \$900,000,000, and since 1907 they have been 40% annually on a capital of \$98,338,300. If this wealth had been accumulated honestly, we would not cavil. It has been won by

crime. Beginning in 1862 with the oil refinery of John D. Rockefeller and Samuel Andrews, the business grew by legitimate and illegitimate methods until Mr. Rockefeller became so rich as to consider himself a specially selected instrument of Providence. His passion for money is veneered by religious sentiment and his piratic greed is thinly disguised as industrial enterprise. At the base of the stupendous commercial structure of Standard Oil is the secret rebate whereby Rockefeller and his associates obtained preferential railway rates, enabling them to throttle their competitors, until the Company had obtained the monopolistic control of the oil market. Others did as they did, but they did it longer and more systematically. To hide the fact that the Standard Oil had made illegal arrangements with the railroads, the chiefs of the Company had to lie early and often, but this they never scrupled to do. Under the pretext of reducing the cost of illuminating oil the Company schemed to maintain the price, chiefly by killing trade rivals and by suborning railway officials. Competitors were compelled to sell out, some of them being forced to continue nominally in business for use as a club against the survivors. Thus by railway discriminations and rebates, by perjury, bribery, violence, and arson, the Standard Oil Company grew steadily to power. It flouted the law; it derided the Government. How deeply its corrupting influence has corroded the public life of America was shown in 1908 when Hearst, the controlling owner of a number of yellow journals, published letters between J. D. Archbold, the treasurer of the Standard Oil, and several senators, judges, and governors. As much as £80,000 was offered to an Attorney-General; as little as £3000 bought a Senator. Espionage and bribery of employees have been common weapons of the big Trust, whereby it has bought the souls of poor creatures, such as the negro who got £18 for smuggling his, a rival,

company's price-book to the Standard managers and for sending information concerning his company's daily shipments for six months. In Germany *schmiergeld* had to be used freely in order to lubricate business whenever the friction of mere honesty proved a hindrance. Even in England the machinations of this intensely American product are not unknown, for two companies registered at Somerset House do service for the Standard Oil. However, the Trust finally developed weakness, for its conspicuously able management has deteriorated, and its business is not as cleverly conducted as of yore. Moreover, natural causes have begun to operate unfavourably. Its strength depended first upon the control of the Appalachian oilfields, then the ownership of pipe-lines and refineries, followed by the free purchase of crude oil. These served to give it a monopoly, but that monopoly is being shattered, fortunately by laws more potent than any passed by Congress. The laws of Nature are inexorable. The distribution of natural products is now against the Standard Oil. The monopoly was based on kerosene, for illumination, the product of the Appalachian region being rich in kerosene. In California the discovery of reservoirs of fuel-oil has led to an industrial development that is independent of the Trust. Fuel-oil needs no refinery, save for by-products; in California it is produced close to tide-water, and is easily marketed. In Galicia and Rumania the oil produced is rich in benzine, which is used as motor spirit; in Burma, Sumatra, and Borneo the crude oil yields a wax, for which there is much demand in the East. Meanwhile the price of kerosene has fallen steadily, in part because electricity has supplanted it for illuminating purposes; concurrently, the motor industry has grown, and is growing, so that a demand has been created for benzine—an oil product previously deemed of no account. The kerosene era is passing, the future belongs to benzine and fuel-oil. It is these de-

oil parents, together with the discovery of new oilfields in many parts of the world, that menace the Trust and promise to break its power more effectively than any law permitting a varying interpretation.

Waihi.

Anyone who had been asked what transpired at the Waihi Gold Mining Co.'s annual meeting might have replied: One hour. The directors had it all their own way. They deserved the unqualified success that crowned their effort to allay opposition, for those who had been busy in criticism elsewhere failed to enter an appearance, so that notes of disagreement emanated only from one or two futile persons whose remarks were received with patience rather than approval. The proceedings left an impression that the directors were working sincerely for what they deemed to be the best interests of the company, and that the chairman, Mr. Arthur M. Mitchison, was a highly conscientious official, anxious to do his duty under unpleasant, as previously under pleasant, circumstances. We confess that we expected some reasonable discussion and some searching questions concerning the administration of the mine. None were offered. Such as were suggested were presented ineffectively. It appeared to us, as we listened to the chairman's speech, with its touches of humour and its lapses to sentiment, that the interests of all concerned might have been furthered by frank criticism intelligently and fairly submitted. Annual meetings ought to afford a chance for disgruntled shareholders to air supposed grievances and for directors to give such explanations as may remove misunderstanding. Instead, we read anonymous attacks in papers of varying character, creating unrest and undermining public confidence; then when a chance arrives to submit criticism it is withheld, while the chairman in full armour rides up and down the field inviting any bold spirit to break a lance with him. At the Waihi

meeting the lances were turned to shovels and the spears to drills, the general sentiment being that enough had been said and that vigorous prospecting in depth was now the only policy to follow. We congratulate the directors on the strong support given to them. Even the rampagious New Zealanders took a back seat and compromised an impossible issue by withdrawing the proposal to transfer the control of the company to the Dominion. They were met tactfully by the election of Mr. Arthur Rhodes, who, with Sir Westby Percival, will give the colonial shareholders ample representation. The idea of further inspection of the mine met with scant support, no statement of the chairman being so heartily cheered as that in which he said: "We have had enough reports for the present." This is a compliment to the astuteness of the local managers, who, by retaining the services of Mr. G. A. Richard, rendered it improbable that any stranger would be engaged to make an inspection. However, we learn that Mr. Malcolm Maclaren is likely to make a geological examination. We hope this is true. Neither the report of Mr. Williams nor that of Mr. Richard meets the necessities of the case, and manifestly it is absurd to speak of the cost of such special advice in the case of a mine that had paid over £4,000,000 in profit. It is the law in New Zealand, so the Chairman said, that "every shareholder has a right to go down the mine and take a mining engineer with him, if he chooses to do so." As onlookers, not without knowledge in these matters, we commend the legislature of New Zealand on a law that seems calculated to protect shareholders. In the case of such a mine as the Waihi there must be many proprietors having holdings large enough to warrant them in engaging a specialist, who could give them advice of great value. This advice they would use to their own good, withholding publication as long as it suited them. If the company as a whole has no desire for special guidance from a com-

petent mining geologist, then those who do require it should obtain it, pay for it, and keep it. The good faith of the directors is such as to assure to any reputable mining geologist a fair opportunity to study the mine—if retained by a shareholder. The Board is quite right in declining further expenditure in this direction if it feels that the position has been adequately met. As to diamond-drilling, hydro-electric plant, and general financial policy, the Chairman made a satisfactory explanation, the meeting ending with cordial expressions of support and a hearty endorsement of the policy proposed, including a message of goodwill for Mr. H. P. Barry and the staff at the mine.

Rand Mines.

In our advertising pages will be found verbatim reports of the recent general meetings of the Rand Mines and the Central Mining and Investment companies. We take pleasure in publishing these, for, besides affording specific information concerning two important enterprises, they include an authoritative summary of economic conditions in the Transvaal. Rand Mines has been appropriately termed the Consols of the great goldfield adjacent to Johannesburg. The group of properties controlled by the company includes the big Crown Mines consolidation, as well as such important mines as the Nourse, Rose Deep, Geldenhuis Deep, Ferreira Deep, Durban Roodepoort Deep, Village Deep, and City Deep, besides about a dozen more. Most of these were started, as their name implies, below successful outcrop mines with a view to exploiting the Main Reef series at a lower horizon, but these 'deep level' mines have since been followed by others even lower on the dip, so that the term 'deep' has lost much of its significance. Some of the group have lives estimated at from 12 to 15 years only, as against the 50 years allowed to Crown Mines, therefore the recent purchase of shares

in other long-lived companies from Wernher, Beit & Co. is believed to have added to the investment value of Rand Mines. We referred to this matter in our last issue. It was mentioned at the meeting, and our readers are referred to the statement then made. Other interests held by Wernher, Beit & Co. are transferred to the Central Mining & Investment Corporation on a valuation made by a committee well able to make a fair appraisal. In fact the Central Mining takes over the more speculative portion of the Wernher-Beit holdings, while the Rand Mines acquires the firm's interests in well established Rand mining properties. Thus the business created by the late Alfred Beit and Sir Julius Wernher is disintegrated, passing into the possession of two big financial companies. It remains to say, as Mr. Friedrich Eckstein pointed out, that the Rand Mines and the Central Mining differ in one important respect; the former by its constitution is devoted to purely South African business, while the latter is a financial corporation undertaking business of a general character, such as the recent Magadi Soda issue. At the Central Mining meeting a French shareholder made a friendly appeal for the larger representation of his countrymen on the board of directors. This request had evidently been considered before the meeting, so that the chairman was able forthwith to give a cordial response. Three French directors are to be chosen. Other companies will find it advisable to placate French sentiment in a similar manner, so that the *entente cordiale* may extend not only to politics but to mining enterprise. Finally, we regret the absence, due to severe illness, of Sir Julius Wernher, to whom the recent transfers must have seemed a sad valedictory. We hope that his life may be prolonged and that he may be permitted to give useful advice to the foster-children of the firm with which his name was so conspicuously connected.

METAL MARKETS

COPPER.

Average prices of cash standard copper:

May 1911	April 1911	May 1910
£54. 8s. 7d.	£54. 3s. 2d.	£56. 6s. 11d.

Signs are abundant that the long awaited improvement in this industry is not far off. The Standard market already shows a rise of nearly £2 in the month, with indications of a further increase in price. Early in the month conditions pointed to a further relapse, as producers keenly competed with one another, being slightly undersold by dealers; consumers were holding out for fresh concessions, American consumption was still unable to absorb the production, there was a report that the curtailment programme had been abandoned, and finally a cut in the price of electrolytic was made by the Amalgamated interests. The favourable aspect of a steady and continual decrease in the world's stocks was ignored, until the financial atmosphere was finally cleared by the legal decisions in the Standard Oil and Tobacco Trust cases. These events synchronized with a renewal of public interest in speculation, and the other side of the picture came suddenly into view disclosing considerable improvement in the American industrial position, reviving confidence, cheapness of money, and the prospects of a good harvest. Manufacturers there all along have bought sparingly and hold no supplies of importance. A better demand will thus find them ill provided and a reduction in stocks may be reasonably expected.

TIN.

Average prices of cash Straits tin:

May 1911	April 1911	May 1910
£197. 15s. 4d.	£193. 0s. 10d.	£150. 1s. 8d.

A report of this market is merely a record of the piratical operations of the syndicate which is in absolute control and has succeeded once more in raising Cash Tin to £230, while the 3 mos. price rules at £193. Some contracts are said to have been squared at £233. A 'back' of £26 indicated the syndicate's power and determination to use it at whatever cost to the trade and to the interests of the Exchange under whose aegis its transactions are carried on. Its operations which have consisted in buying up May and June dates and squeezing the bears who sold have received much adverse criticism from fellow members, and an attempt has been made to break its power by unofficial dealings in

standard tin with allowances for qualities other than Straits. But these attempts are not regarded with favour and the latest transactions have been at a discount of about £2. America, which remained out of the market until the close of the month, greatly assisted the advance by having to buy freely both in London and in the East. Previously shipments from New York had been made to London to relieve the tension.

LEAD.

Average prices of soft pig lead:

May 1911	April 1911	May 1910
£12. 19s. 2d.	£12. 18s. 5d.	£12. 11s. 8d.

There is a distinct revival in demand and prices have stiffened. The scarcity of prompt metal is acute and in spite of larger arrivals the demand is not satisfied. More interest is shown in forward buying since the scarcity of spot has put a premium on early delivery. Shipments have had to be made from the United States to meet trade requirements and stocks in hands of producers both in Spain and America are much diminished.

SPELTER.

Average prices of ordinary brands:

May 1911	April 1911	May 1910
£24. 6s. 1d.	£23. 13s. 8d.	£22. 1s. 1d.

This metal enjoys uninterrupted prosperity. The demand shows continued expansion in all branches and the production is scarcely keeping pace with it. Stocks in buyers' hands are small, and those held by producers are probably much below normal. Prices consequently are firm with a tendency to rise. Further supplies have been imported from America.

OTHER METALS AND MINERALS.

Prices quoted on June 10:

SILVER.—24½d. per oz.

PLATINUM.—166s. per oz.

BISMUTH.—7s. 6d. per lb.

ALUMINIUM.—£61 per ton.

NICKEL.—£169 per ton.

COBALT.—9s. 9d. per lb.

ANTIMONY.—£30 per ton.

QUICKSILVER.—£8. 5s. per flask of 75 lb.

MANGANESE ORE.—8½d. to 9½d. per unit (1%).

IRON ORE.—Cumberland hematite 19s. 6d. per ton at mine. Spanish 20s. delivered in England.

PIG IRON.—Cleveland 46s. per ton. Hematite 62s. per ton.

WOLFRAM ORE.—32s. per unit (1%).

SPECIAL CORRESPONDENCE

News from our own Correspondents at the principal mining centres

JOHANNESBURG.

East Rand Proprietary.—The destruction of the crusher station on the Angelo-Driefontein section of the East Rand Proprietary was an unfortunate occurrence, on the eve of the general meeting, in spite of its small influence on the actual position of the company. Sir George Farrar had, however, so big a display of figures to lay before shareholders that the temporary decrease in sorting, consequent on the fire, can have occasioned little dismay. The results of the year's work were, briefly, 2,126,334 tons crushed for a yield of £2,900,883, or 27s. 3d. per ton, at a cost of £1,651,527, or 15s. 6d. per ton. The ore reserve statement was exceptionally favourable, showing the following classification: 'Payable'.....10,273,875 tons at 6'6 dwt. 'Unpayable'..... 3,676,402 tons at 2'2 dwt.

Total.....13,950,277 tons at 5'4 dwt. These are milling tons, allowing for the removal of 14'7% waste.

The figures indicate a much higher reserve even than that of the Crown Mines, which declared 7,248,314 tons (mining) at 7'0 dwt. The ore crushed amounted to 2,126,000 tons against 1,514,000 tons by the Crown Mines. The East Rand Proprietary has long been able to boast of a low working cost and last year's figure of 15s. 6d. is highly creditable. A little explanation is desirable on one point, however, before it appears safe to compare the expenditure per ton with that of any other mine. During the year, there was accomplished the magnificent development footage of 110,084, which would merit greater applause if the cost were not so excessive. The balance-sheet shows an increase for the year of £430,000 under "Excess Development and Shafts," and a charge of 2s. 6d. per ton milled was also made against working cost for development, bringing the total to £626,000 or the abnormal figure of £6. 6s. per foot. The proportion of shaft-sinking accomplished was not enough to account for the remarkable discrepancy between this amount and the Rand's average cost of miscellaneous development on a producing mine. Certainly, the amount charged to current and excess development should have been analysed, to enable share-

holders to see whether the economy and efficiency of development operations stand on a level with the standards shown for other departments of mine work, or whether we are merely faced with the perplexities attending the lack of uniformity in the methods of technical book-keeping adopted by the different groups.

Groenfontein.—Although this tin mine showed a decreased output for 1910, the results prove that a high average grade of ore has still been maintained. With 10 stamps, 12,161 tons was crushed for a yield of 864'6 tons of black tin (70'9% metal), equivalent



Vertical Shaft of the Anglo-Driefontein.

to a 7'1% yield. Working expenses totalled £42,167, leaving an estimated profit of £33,287. The company does not appear to have had the good fortune, in regard to deeper development and prospecting, enjoyed by its neighbour, the Zaaiplaats. D. H. Doveton, manager of the Groenfontein, reports that an Elmore plant has proved successful for the elimination of sulphides from the concentrate.

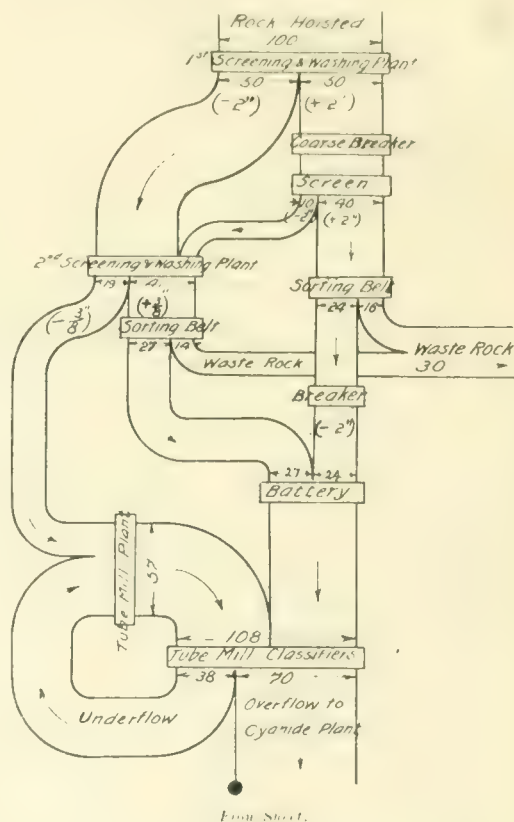
The Latest Producer.—Following the Randfontein Central, which is now reported to have from 300 to 400 stamps in operation, the latest addition to the list of Rand gold-producers is the Brakpan, which starts with a strong ore-reserve position. The estimate at the commencement of crushing stands at almost 2,000,000 tons of ore at 6'6 dwt. Allow-

not for a few per centage of rock mined from development faces and unprofitable blocks, for 12% sorting, and for a 90% recovery (covering loss in residue and the probable discrepancy between mine sampling and gold won), the yield per ton may be taken at 26s. 6d. The plant is designed for 60,000 tons monthly capacity and involves many features only recently introduced upon the Rand. Slime agitation in Pachuca vats will be followed by vacuum-filtration in Butters plants. There will also be zinc-dust precipitation and filtration in Merrill presses.

Technical Sensationalism.—It is most unfortunate that C. O. Schmitt of the Consolidated Gold Fields should have seen fit to commence his paper, lately read before the Chemical, Metallurgical, and Mining Society, on 'Future Economies in Rand Production Plants,' with a gratuitously misleading statement of average grades for various depths of ore on the Rand. Mr. Schmitt's paper contains much that is of interest and value, but its claim to serious attention is almost wholly dispelled by the initial assertion that the average value of the ore is gradually dropping 5s. to 2s. 6d. per ton every 1000 feet. The screen value of ore per ton milled is tabulated by him as follows: 1000 ft., 40s.; 2000 ft., 30s.; 3000 ft., 25s.; 4000 ft., 22s. 6d., and 5000 ft., 20s. A similar assertion, advanced without a vestige of proof, was made by him two months before at the meeting of the South African Institute of Engineers; but now the proponent of this bold theory, by which the Rand is calmly being consigned to speedy perdition (unless the Schmitt system of treatment be adopted) shows his hand by declaring that the statement is merely his "interpretation of the published returns for the whole Rand, which obviously do not make any allowance for a deliberate reduction in grade" rendered possible by low working costs. In other words, the analysis is worse than valueless and too frail to stand criticism. By what means did Mr. Schmitt arrive at his average depth of ore hoisted, to provide a safe basis for this vital comparison? What is meant by average grade? the value of ore mined, regardless of its percentage of total ore, or the value of profitable and unprofitable reserves? No indication of the proportions of each reef mined is presented by the Chamber of Mines returns. The author of the gradual impoverishment theory proves the utter unreliability of his figures when he acknowledges that "it is impossible to estimate the average depth from which ore is mined at the present day" and

adds the remarkably informative statement: "At any rate it is known that while some mines work at a comparatively shallow depth, others obtain the ore from below 3500 ft. and even 4000 ft." It is fruitless to discuss the question. It is only my wish to demonstrate that the analysis published is without scientific foundation and can be ignored.

Economies in Reduction Plants.—The principal improvements which are suggested by Mr. Schmitt and which could have been presented without any sensationalism, involve much closer sorting of waste rock, the de-

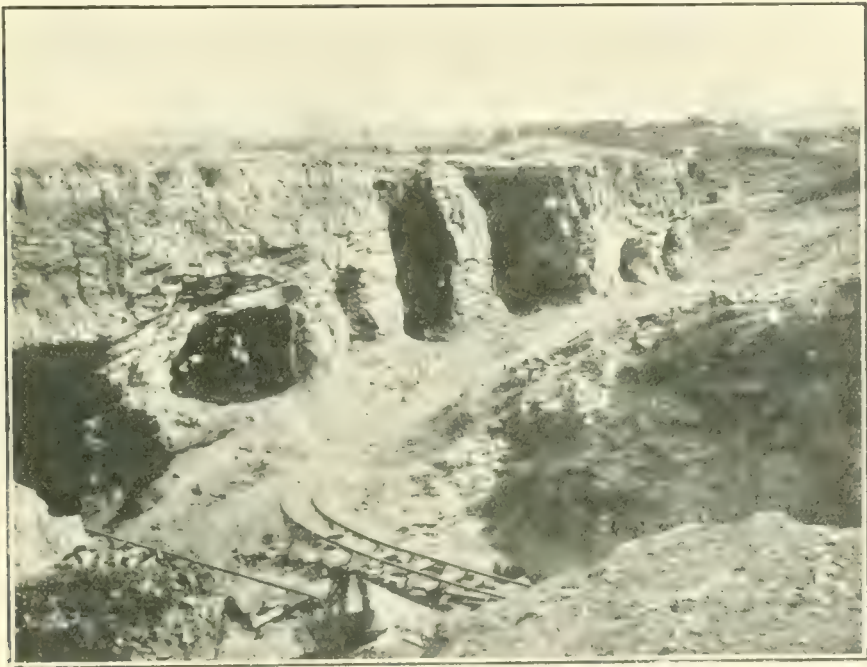


livery of the fine from underground, which will pass a $\frac{3}{8}$ in. aperture, direct to the tube-mills and that passing a 90-mesh screen direct to the cyanide plant, and the replacement of stationary grizzlies for screening ore by some "more efficient device" (trommels). An emphatic verdict is pronounced in favour of double-stage crushing in stamps and tube-mills, the benefits of which practice—though extending from one end of the Rand to the other—have lately been brought into question. The chief weakness in the scheme outlined appears to be in the fallacious assump-

tion that 30% sorting is economically advantageous under average Rand conditions, and in the erratic basis of calculation for comparisons of sorting cost (current and capital expenditure) on a 16% and 30% basis.

Take one of several variations of the modified schemes, for which Mr. Schmitt gives a diagram printed on the preceding page. To indicate the inaccuracy of the figures employed in support of this system, it may be stated that the cost of sorting under existing methods is placed at 70s., for 70 tons subjected to sorting, when 16% is sorted out, while the corresponding figure for the new scheme is given at 81s. with 81 tons sub-

frequent in the paper, which contrasts strongly with those generally emanating from the Consolidated Gold Fields' technical branches. As a rule we hear of practical results when they have been achieved and when conclusions are more or less final. It is quite unusual to hear this beating of a big drum over the fascinating amusement of devising imaginary tables of costs and flow-sheets. There is no sin, truly, in presenting these hypotheses to the public, but it is beyond the endurance of any Rand mining man to accept such estimates, full of self-evident inaccuracies, with expressions of gratitude for this timely salvation of the industry from a horrid doom.



OPEN-CUT WORKINGS OF THE SIMMER & JACK

jected to sorting, when 30 tons is sorted out—and 14 of these tons from the troublesome product ranging from 2 in. to $\frac{3}{8}$ in. aperture. The cost of sorting, it should not be necessary to explain, is chiefly governed by the percentage of rock sorted out, not by the percentage looked at, as it travels along a belt. Instead of 70s. per 100 tons hoisted, the figure should have been about 30s., to be representative of existing Rand practice. Capital expenditure is calculated proportionately to tonnage subjected to sorting, regardless of whether there must be accommodation for 16% or 30% sorted out. This inaccuracy of calculation is too

Simmer & Jack.—One of the accompanying photographs depicts the open-cut workings in the central portion of the mine. The success attained in open-cutting the outcrop on the western area of the Simmer & Jack, adjoining the old Stanhope or Burnham mine, has evidently encouraged enterprise elsewhere on the property. It is interesting to note that this outcrop work is being done while the Jupiter and Simmer Deep companies are working below at an incline depth of six or seven thousand feet. The photograph on page 419 shows the type of skip and double-deck cage commonly in use.

City Deep.—To those who expected to see the City Deep run up rapidly into the front rank, early returns have proved disappointing. It must be admitted that better results were expected on all hands. The main point for consideration, however, lies in the obvious fact that low tonnages and high costs are at the bottom of the trouble, and not any deficiency in grade which has fulfilled anticipations, so far as can be observed. The short tonnage is a matter that should fortunately be under control and it is most probable that any initial difficulties, through poor air (power and ventilation) or ill-trained labour, will soon be overcome by the management. J. Whitford has long held the reputation among local managers, since the days of his economical handling of the Robinson Central Deep, of being one of the most expert in the art of breaking ground.

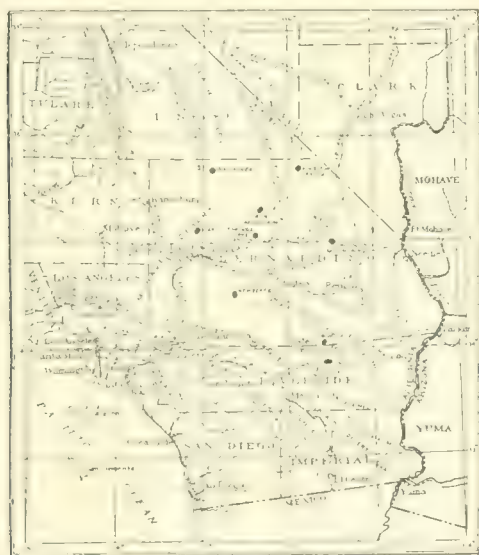
Miners' Phthisis.—An utterly unreasonable outcry has arisen on account of the amendments introduced by the Government to the Miners' Phthisis Compensation Bill. The task of arranging affairs to the satisfaction of all parties would have been beyond human capability and harsh criticisms were inevitable, whatever decisions eventuated. The chief cause for exasperation in labour circles (as expressed by their Press) has been the proposed enforcement of a small contribution by miners to the compensation fund. It is proposed that rock-drill men earning 21s. 3d. to 38s. 2d. per day should contribute 5s. per month (from $\frac{1}{2}$ to 1%) to the fund, and men earning from 18s. to 24s. 9d. a day, 2s. 6d. per month. The soundness of this scheme, which appears to be far from exacting, must be obvious to all unbiassed by political or socialistic prejudices. The payment of compensation to sufferers from phthisis will force the mines to take precautions, in the matter of providing water-sprays and better ventilation against underground conditions favourable to the generation of the disease, but something must surely be done to influence the men to help themselves. That miners are mostly careless in the matter of observing proper precautions is a circumstance which even labour leaders are unable to deny. How often do we see men working in flying dust at a development face, without making an effort to use the spraying facilities at hand and without a respirator. The orders of the shift-boss effect but temporary reform. Because miners' phthisis is a danger that cannot be seen or touched like a loose 'hanging,' and because the faculty of imagination is fortunately not

greatly developed in the average machine-man (except in the estimate of his fathmage before measurement day), some stronger reminders are needful to emphasize the call for constant attention to the benefits of precautionary measures. The deduction of 2s. 6d. to 5s. per month demanded will at least prove an influence in the right direction. Men willingly pay more than this to the Benefit Society, and should be prepared to contribute toward insurance against a sickness for which their carelessness is in some measure responsible.

SAN FRANCISCO.

Steel Corporation.—The sale of the Risdon Iron Works, in this city, to the United States Steel Corporation has been announced and it is also reported that options have been taken on the Moran shipyards at Seattle as well as on terminal properties at Portland and other Coast points. The history of the Risdon works is the history of San Francisco. Established at Bush and Market streets in the early '50s by Lewis Coffey and John Risdon, two New York boiler-makers, the plant was later removed to Howard street near First, and at one time had the backing of the four 'bonanza kings,' Mackay, Fair, Flood, and O'Brien. In the beginning it was only a blacksmith and boiler-shop, but grew rapidly until it took on the importance of an iron works and at one time during the Comstock excitement was known as the Risdon Iron & Locomotive Works. Only one locomotive was ever manufactured, and part of the title was dropped upon removal to the Potrero. After the deaths of the original owners, the plant became the property of William Taylor, a steamboat master, who, pleased at the excellent product of the works, bought an interest in them. At his death the ownership passed to his heirs, and Augustus and W. H. Taylor, his sons, signed the deed that gave ownership to the Steel Corporation. At one time the Risdon works employed 1500 men. It was noted for the excellent marine engines and other work turned out. Much mining machinery has been built, in particular, the first dredges used in California. Of late years the steel industry has languished and but a mere handful of workmen has been employed. The management was seriously considering closing down the plant when the opportunity to sell was presented. Purchase by the Steel Corporation of the Risdon and other works follows activity on the part of men connected with it in examining and buying iron ore

deposits, of which there are several of value in southern California. There is much talk locally of immediate erection of blast-furnaces, but nothing authoritative has been announced. All the city properties selected are notable for their excellent situation as regards receipt and re-shipment of freight and it may well be that for the present the move means merely that the Corporation purposes to carry large local stocks and sell direct. This enlargement of the local activities of the largest American business institution is the first tangible sign of the approaching completion of the Panama Canal.



The Iron Deposits of Southern California.
U. S. Geological Survey

Oil operators have had less diversion in the last month, and rumours have been less startling. The deal for the Associated Oil Co., if there ever was one, seems to have fallen through and the stock has dropped back to its old price on local exchanges. The Associated, though earning a profit of \$2,454,213 for 1910, has not thought fit to distribute any dividend. The Silver Tip property is said to have been added to the number of those purchased by W. P. Hammon and his associates for the Consolidated Oil Lands Co., but no authoritative announcement has been made. Baron van Riegersberg Versluys has been in California and rumour has it that the Royal petroleum company is to enter the local field with T. Deterding, now in London, as managing director. What properties are to be purchased has not been announced but there is a suggestion that the Hollanders were after the Asso-

ciated. The case of certain 'jumpers' against the Southern Pacific, in which it was claimed that the title of the railroad company to California oil-lands is defective, has been decided by local courts favourably to the railroad. The ground taken by the Court is to the effect that fraud, if any existed, was against the Government and that the latter alone has the right to inquire into the matter. Most attorneys who have investigated the matter do not attach much importance to the reputed defect in title.

Mine-rescue work and accident prevention in metal mines is beginning to attract deserved attention in the West. An excellent general report, including a suggested law, was drawn up by a committee consisting of Messrs. W. R. Ingalls, J. Parke Channing, James Douglas, J. R. Finlay, and J. H. Hammond, and submitted to the American Mining Congress, the American Institute of Mining Engineers, and the Mining & Metallurgical Society of America, and has been widely discussed, especially by the various sections of the last-named society. The report of this committee was taken as a basis in framing a new mining law for Nevada. A mine-inspection Act has been passed in California but whether it will receive the signature of the Governor, as is necessary before it becomes a law, is uncertain. The Goldfield Consolidated Mines Co. some time since organized a department of inspection and now has a trained mine-rescue team. The crew consists of eight men, familiar with the underground workings and skilled in work while wearing the Draeger oxygen helmet; suitable training quarters have been provided, and daily practice is held. While U.S. Bureau of Mines Rescue Car No. 4, was at Goldfield, Sumner S. Smith, the engineer in charge, gave the team thorough training in the use of helmets and in first aid work. It is hoped that corps may be formed at other mines and a system of district competitions comparable to those in the anthracite mining districts be organized. In the meantime Mr. Smith has been transferred to Alaska, where he will have charge of mine inspection for the Bureau of Mines.

Cordova, the ocean terminus of the Copper River & Northwestern railroad in Alaska became the centre of attraction recently through the action of its citizens in throwing into the harbour a large stock of coal belonging to the railroad. The action was illegal and unjustifiable from any ordinary view point, but it accomplished its purpose in that it indicated the depth of feeling in Alaska over the unsatisfactory treatment of that territory by Washing-

and the title. Good properties but a few miles from the famous Belling River coalfield, which are well known to be both extensive and rich. Owing to legal restrictions and administrative orders it has been impossible to get title to land and so to open mines. Therefore the railway, which started to build to the coalfields, must pay a tariff designed to encourage local industry. It would be really funny if the matter were not so serious. The question of title became tangled with that of monopoly and with partisan politics until things were brought to a standstill. Fortunately there is a new Secretary of Interior, a competent and honest man who has public confidence, and a satisfactory solution will be reached. In the meantime, however, Alaskans have had to submit to great injustice and their fighting spirit has boiled over. Popular sympathy is with them. How immediately effective it may be is not so certain.

TORONTO.

Porcupine.—Mining activity at Porcupine has been seriously checked for some weeks by heavy spring floods, which have cut off the towns on Porcupine lake from the camps, submerged large sections of the country and rendered the roads impassable, in addition to carrying away bridges and doing other damage. In consequence, operations have been suspended at some of the mines, and the carriage of supplies has been rendered impossible or attended with great difficulties. At last accounts the conditions were slowly improving. The railroad is being pushed rapidly to completion and the expectation is still entertained that it will be ready for traffic the whole way by July. In the meantime machinery cannot be delivered. The rails have been laid for about 15 miles to the Frederick-House river and trains will be run to that point beginning this week. From the Frederick-House river bridge to Porcupine, a distance of about 10 miles, travellers can go forward by launches and canoes. There is a decided increase of activity in the stock market and Porcupine shares have steadily advanced. Hollinger still holds the lead, selling for upwards of \$12. It has a recent rival in Rea, for which there has lately been a strong demand, sending the shares up to \$7. The cheaper issues have been generally appreciating, with occasional recessions and any pronounced advance is usually the signal for a rush of profit-taking, showing the highly speculative character of operations. Recent reports from the district appear to justify an optimistic view as to share-values

in cases where the companies possess an adequate working capital. A question that is attracting some attention among mining engineers is whether Porcupine ore should be handled with cyanide plants in addition to stamps. At the Hollinger and the Dome the cyanide process is being adopted, but in the opinion of the majority of engineers this feature of the equipment is unnecessary, or at least premature, as it is claimed that free-milling ore will be produced in such large quantities that cyanidation may well be relegated to the indefinite future, and that it is better to learn more of the character of the orebodies before incurring the extra expense. Sinking by hand has commenced on the two groups of claims that are being operated by the Bewick-Moreing interests, those to the east of Pearl lake being known as Camp No. 4 and the claims in North Tisdale as Camp No. 2. Compressor plants have been erected but Manager Williams has decided not to use them for shaft-sinking, considering it cheaper and easier to depend upon hand-work until a good depth is reached. Trenching and stripping are being carried on to discover quartz bodies that may give indications of ore at depth. On the Rea a shaft is down over 200 ft. and driving is in progress to prove the vein. Free gold is visible in the pay-shoots. Work is being pushed on the Hollinger at the 200-ft. level, a winze having been sunk for 100 ft. from the 100-ft. level, with results said to be excellent. Driving has been done to the extent of 1400 ft. and cross-cutting for 700 ft. At the Pearl Lake mine, where work was recently discontinued on account of water in the shafts, operations have been resumed. One shaft is down 45 ft. and two others are being sunk. At the Dome Extension a newly discovered 30 ft. vein is showing up well. Three working shafts are being sunk and a large body of ore is blocked out. On the Jupiter, abutting on the Pearl Lake, some important finds have been made. Six large veins have been exposed, one of them 20 ft. wide. The Royal Porcupine, situated south of the Vipond, has uncovered three strong veins. A force in charge of Julius Messer has begun development work. Diamond-drilling on the Babyan claim at the bottom of Gillies lake has disclosed a lode of quartz 10 ft. wide carrying free gold. It will be worked by means of a cement shaft to the bottom of the lake.

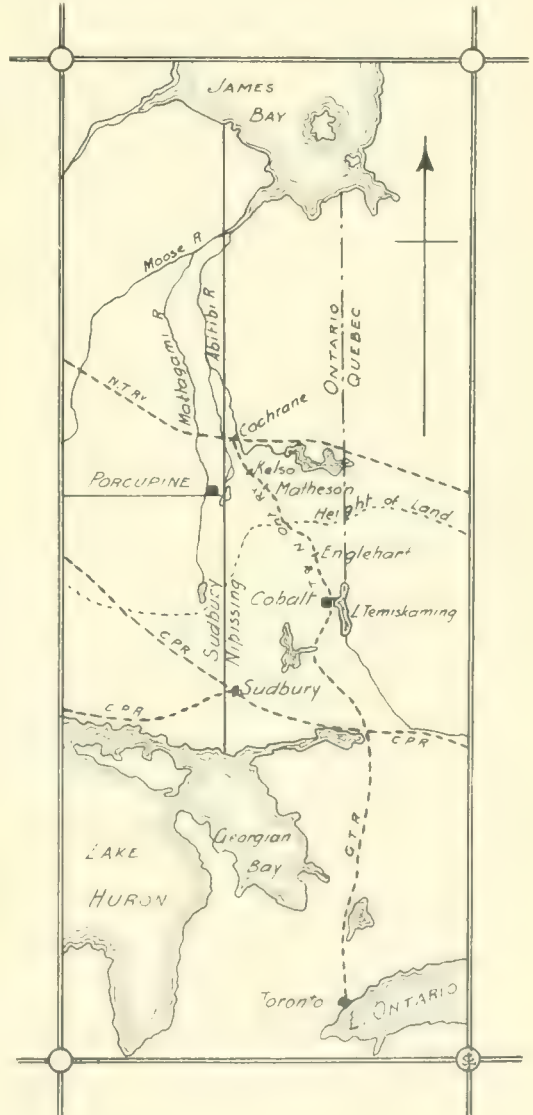
Swastika.—At this mine, about 20 miles south of Matheson station on the T. & N.O. Railway, where operations have been carried

on for three years, gold to the value of \$4400 have been produced in the last seven weeks. A 5-stamp mill is in operation. The main shaft is down 100 ft. and is to be sunk to the 500 ft. level. Interest in the Swastika district has been growing and many people are coming in.

At Cobalt production has latterly been at a low ebb on account of the shortage of power. This difficulty has been gradually overcome with the disappearance of the ice on the rivers. Last week saw the resumption of operations on nearly all the properties which had been obliged to close down and shipments showed a decided improvement. The growth of bullion consignments continues, and largely accounts for the decrease in tonnage. Last week the Nova Scotia, Nipissing, and Buffalo shipped an aggregate of 107,785 oz. bullion. The total bullion shipments of the year to date amount to 1,047,890 oz., valued at \$505,038. The La Rose is opening up a third level in the main shaft at 270 ft., the deepest point attained in the workings. A drift is being pushed along the main vein to reach the ore-shoot developed on the upper levels 300 ft. from the shaft. The total shipments last year amounted to 2,118,574 oz. silver, of a net value of \$1,040,934, the cost of production being 19'11 cents per ounce.

The annual report of the Nipissing stated that notwithstanding the production of over 5,500,000 oz. silver, enough additional ore was developed to replace the large output. The cost of production was 14'71 cents per oz. The company had a surplus at the end of the year of \$952,799. The ore reserves are valued at \$3,276,440, taking account only of high-grade ore. The Crown Reserve is adopting a policy of deep mining and in the winze on the Carson vein sunk from the 300 ft. level, a depth of 150 ft. or 450 ft. from the surface has been reached. The deep workings of the Temiskaming do not show a continuance of the high-grade ore found on the 500 ft. level. It pinched out 60 ft. below that depth. Chas. A. O'Connell has been appointed manager of the Trethewey in place of George MacNaughton, who resigned in order to attend to his interests in Porcupine. Silver Leaf, the shaft of which is down 420 ft., is being worked by the Crown Reserve, which has leased the property and will sink further so as to cut the Keewatin formation. The Rochester, which was closed for some time owing to financial difficulties, is again being developed. The main shaft will be sunk to 300 ft. The Cobalt Lake is making rapid progress with the erec-

tion of its 20-stamp mill near the main shaft and it is expected to be in operation by the end of August. It is stated that a supply of milling ore for two years is in sight. At the Green-Meehan about 1000 ft. of driving has been done since the property was leased by



A. W. Thomsen, and the ore taken out solely in the course of development has more than repaid the outlay of \$30,000.

Gowganda.—The announcement is made that the Millerett and the Miller Lake-O'Brien mines will shortly make several shipments in spite of the bad condition of the wagon roads. A vein has been discovered on the former property carrying several feet of milling ore.

A mill will be completed during June and in future concentrate as well as high-grade ore will be shipped. In the absence of transportation facilities, few of the mines in this district can be profitably worked, as the cost of production is prohibitive.

SALT LAKE.

Bingham.—Increased production by the Utah Copper company in the near future is predicted by many who have been studying the report for the quarter ending March 31. These three months showed a gross production of 21,296,709 lb., as compared with 22,188,719 lb. for the last quarter in 1910. The total net profit, including the Nevada Consolidated dividend of \$375,187, was \$1,174,508. This is an increase of \$302,550 over the corresponding quarter of last year, but no Nevada dividend was paid then. The Utah Copper dividends for this last quarter were \$1,171,987, leaving only \$2,521 to be added to surplus account. The tonnage treated was 981,104, an average of 10,900 tons daily as against 1,047,318 tons for the previous quarter. This is only about half capacity, as the Magna mill is now ready for its maximum and the Arthur mill is being overhauled by sections and will soon be in such shape that the two will be able to treat 20,000 tons per day. As it would take something like three months to get any increased production on the market, conditions may be such by that time that the additional output may be readily absorbed. The average net cost per pound for the quarter is given at 8'434 cents, as compared with 8'227 c. for the quarter previous. The ore averages 1'55% copper. Extraction by the concentrators was 69'98%. The report says: "Earnings are computed on a basis of 12½ cents a pound for copper for the month of January and 12¼ cents per pound for copper for the months of February and March. At the close of the quarter no copper due for delivery to the refineries remained, but, on the contrary, sale had been made of all copper due for delivery up to near the middle of May, or an average of about 50 days in advance of dates upon which the metal is available for delivery."

Ely.—The report for the same quarter by the Nevada Consolidated, at Ely, Nevada, controlled by the Utah Copper, shows a production of 15,893,743 lb. copper, as compared with 15,698,595 for the preceding quarter, and 18,100,258 for July, August, and September of 1910, and 13,528,647 lb. during the first quarter of that year. The ore averaged 1'84%

copper and the cost per pound is given at 6'99 cents, after writing off depreciation for the Steptoe plant. Net earnings for the quarter were \$1,012,729. A dividend of \$749,380 was paid, \$14,788 charged to depreciation of the Steptoe plant, and \$126,466 added to the surplus account. The company is now using oil instead of coal for fuel at the Steptoe plant, and reports satisfactory results.

The adit of the Utah Metals Mining Co., driven to open some of the leading mines at Bingham to great depth, is now in over 5000 ft., or half-way through the mountain. Two shifts are averaging five to six feet per day, at a cost of \$11 per foot. Several companies are negotiating for the privileges of transport through the tunnel to the Tooele smelter of the International Smelting & Refining Co., to which it will lead in a direct line.

Lead ores have been coming in at such a rate to the Tooele plant of the International Smelting & Refining Co. that the announcement has been made at the offices here that the proposed capacity of the new smelter will be doubled. It was originally intended to plan for only 250 tons of lead ore per day, but the specifications have been changed to provide for 500 tons daily for the first unit. The company is handling between 600 and 700 tons of copper ore daily at the present time.

The complete success of the bag-house system of the United States Smelting, Refining & Mining Co. for controlling smelter fume has again been demonstrated by the recent verdict in favour of the company in the last of the damage suits against it for injuries through fume. A farmer claimed that his sheep had been killed by eating grass which had been poisoned by fume from the company's smelter at Midvale. Frederick Lyon, in the annual report, discusses the experience of the company in handling fume from copper ores by the bag-house method in the company's plant at Kennett, California. He says the success there has been complete, although the original capacity of the bag-house, which was installed July 5 last, proved insufficient, and the company was obliged to operate at about half capacity for some time in order to comply with the order of the court and the agreement with the farmers.

Custom ores will hereafter be received at the Magill smelter of the Nevada Consolidated. This will make it possible to work a large number of mines that have ores of too low a grade to ship to Salt Lake, where the nearest other smelters are. Ely Western shareholders are offered an exchange of one

share of Boston Ely for 30 shares of Ely Western. The latter company is controlled by the former, whose ground it nearly cuts in two.

Mason Valley.—The Nevada Douglas is completing the railroad to its mine, and it is stated that railroad and smelter will be completed and in operation early in September. Officials of the company say that they will be able to produce 10,000 tons of ore monthly and make copper at 8 cents per pound.

Tonopah.—Tonopah-Belmont has declared a dividend of 25 cents, or \$375,000. This makes a total since organization of \$1,718,000. The directors have decided to build a new 450-ton mill, which it is expected



will save \$2.25 per ton and make it unnecessary to ship any ore to the smelter. The annual report shows that for the fiscal year the gross earnings were \$2,314,205, operating expenses (including depreciation) \$811,824; net operating profit \$1,502,381. Other income brought the total net earnings to \$1,522,301. The surplus account is \$1,185,867, of which \$1,162,446 is cash. The management estimates the ore in reserve at \$11,492,000.

A large interest, said to be control, of the Halifax Tonopah, has been sold by Thomas Kearns and David Keith of Salt Lake to F. M. Smith of California. The property adjoins the Tonopah-Belmont on the east.

MELBOURNE.

Labour Questions.—It is impossible to ignore the importance to Australia of the vote taken in connection with the late referendum on the control of monopolies and labour matters. At no previous time has the Press been so united. When federation was proposed there were many waverers and some determined opponents. Now the Press of Australia, with the exception of a few labour organs, has denounced in set terms the ambition of the labour party in the Federal Parliament to filch the rights that the States specifically retained when in 1901 they consented to federation. The significance of the vote has to be understood. For many years politicians, first in the State Parliaments, next in the Federal Legislature, have had the one idea of placating labour. It did not matter whether the demands of the party were economically sound; expediency gained the day and legislation was passed, the effects of which exceptional prosperity alone has concealed. Labour was able to achieve its purpose because it did not take office. Now when in office it has a united opposition to face. Next it has the responsibilities of government. This burden has been accepted with complacency, and it has striven only to "shear the fat man" of his fat. In other words, its one aim and object has been to pinch capital at every turn and to mark every successful enterprise as being a fit subject for nationalization. Imagine the mistrust thus occasioned in every branch of industry. Wages boards in the States have advanced wages everywhere and then Commonwealth taxation was proposed in a form that meant ruin. On top came the threat of Federal state-banking and incidentally the nationalizing of coal mines and other enterprises. The vote cast against the referendum indicates most plainly that a sense of alarm exists throughout the community at the wild-cat politics of the Labour party. That vote has driven the lesson home that the adherents of the party fall far short of a majority of the electors and that therefore an appeal to the country by it would show that the small majority it gained eighteen months ago would disappear. Of course two years must elapse before a general election and it may be said that the party will seek to amend its ways before then. But it cannot be moderate. This is because the men low down in the ranks are not content with moderation. They clamour for aggressive legislation, as was fittingly exemplified in their badge at the referendum: "Vote Yes and give us a chance." That such a request should be made in a country afford-

ing the workers to many opportunities to secure a position of comfortable independence is a sign that cannot be disregarded. Land in Australia is given away practically for the asking, the farmer cannot get the labour he requires, the mines are asking for workers, wages are high, and the cost of living is low.

State Coal.—If any object lesson be required to demonstrate the correctness of the view taken by the elector, it is to be found at the State coal mine at Wonthaggi, in Victoria. The genesis of that enterprise has already been outlined. It was founded at the time of the strike at Newcastle, and was to place the Victorian railways and the Victorian public out of all danger of a coal famine. The State built a railway to the mine; it established a model township, provided a drainage and water scheme, established brick-works, and equipped the mine. The promise of comfortable working conditions attracted miners from every quarter. Now the mine is in full work, so that it is fair to judge results. First of all it is found that the coal, which was represented to be as good as Newcastle, is less valuable for steam purposes. Next it is discovered that it is more friable and consequently a larger proportion of slack is made. This means that the mine could not be made to pay unless the slack is sold to the public against the product of the other coal mines, or unless wage conditions are regulated. The latter alternative could not be contemplated, so the slack has been sold, and the other Victorian coal mines suffer. No doubt the people who get the fuel benefit from the State not making any profit, but they pay for it in other ways. Then the discipline at the mine is deplorable. Trouble arises if the manager puts a man off or if he says the mine is to be worked in a certain way. Fault is found with working places and a conference has to be held with him. A prize-fight takes place in the locality, and the wheelers go on strike, ostensibly because a man has been given his walking ticket, really that they may attend the fight. Wages run up to 16s. per shift, and a standard is created that tells against every other mining centre in Victoria. Apart from that, the efficiency of the labour is low. In the township the residents have been provided by a paternal Government with every requisite that officialdom can suggest. Still they are dissatisfied and clamour for more. On the other hand to create the mine an altogether extravagant expenditure was incurred; then, to silence criticism, especially in Labour circles, the easiest of working conditions were established. The result is dissatisfaction

among the workers and the lowering of their efficiency. It is the old story of the State pauperising a community and then having no respite from the demands made upon it.

Labour at Broken Hill.—The same kind of sore is being opened at Broken Hill where the directors gave in to the men at the beginning of this year and conceded an increase in wages of practically 1s. per shift. It was hoped that the effect of this concession would be to make the mining population more contented and harder working. Instead, they are full of discontent. Managers complain that they do not get the efficiency they expected when the agreement to increase wages was signed. Labour also is not flowing to the district in the way they hoped, for the simple reason that the local union is warning other districts that it highly disapproves of any men moving to Broken Hill. Of course there is some drift thither, but the compactness of the organization may be estimated from the fact that a guarantee given by the mines to men out of work at Newcastle to proceed to Broken Hill resulted in hardly a man moving from the one district to the other. The most sinister fact is that no disposition is shown by the men to work hard. It would appear as if they had agreed to restrict their week's earnings to a fixed sum, as in the brick-laying trade where a man who lays more than 400 bricks a day is apt to meet with an accident, although formerly he was able to lay 800 bricks per diem. If the zinc problem had not been solved it is not hard to see that the mines at Broken Hill could hardly pay with labour so negligent and inefficient.

Labour at Mount Lyell.—The latest field of attack is Mount Lyell whether Mr. Justice Higgins, of the Federal Arbitration Court, has journeyed to determine working conditions. The engineers and firemen are the applicants for better wages and they will have to be given a higher rate. This can be asserted because Justice Higgins' attitude has already foretold his decision. The great complaint made against him is that he is receptive only on the Labour side. His interposition in Labour matters has been much akin to that of the State at the Wonthaggi coal mine, for the effect of his judgments has been to occasion discontent and create fresh demands under which employers will fail when bad times supersede the present season of plenty.

Wolfram.—News is to hand from the Northern Territory of a fine discovery of wolfram near a rivulet known as Horseshoe Creek. The discovery is said to be the lar-

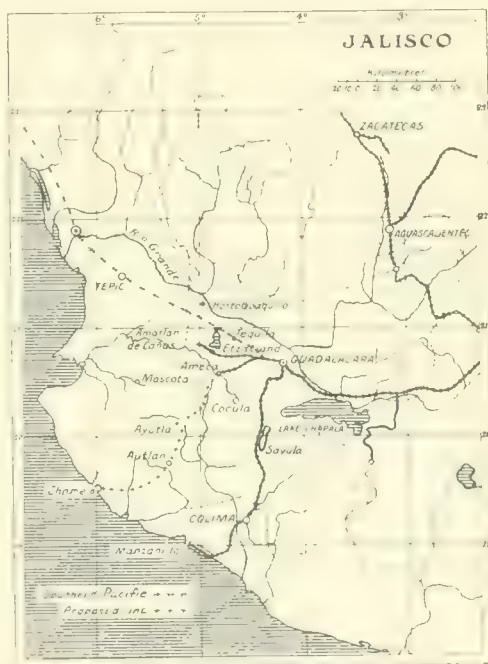
gest deposit of wolfram yet exposed in Australia. The mineral is so erratic in occurrence, however, that the public takes the information calmly. Tin has been found nearby, and it is also said that some bismuth has been proved in the same district.

Bullfinch.—Developments in this district are as rare as gold on the seashore. One or two patches of rich ground appear to have been found, but that is all. While this is so, events in Bullfinch circles have been moving fast. First of all has been the public congratulations given by University men and others to Messrs. Greenway and Dyason upon the break-down of the charge of conspiracy against them over the Great Chaffinch mine. Next has come the demand of those interested in some of the Bullfinch flotations that the boomsters shall be carpeted. The Chamber of Mines of Victoria is suggesting that the Kalgoorlie Chamber of Mines shall appeal to the West Australian Government to investigate the inflation of share-values. To do that would mean that the West Australian Government would have to place in the box the men who were not called in the recent prosecution of Messrs. Greenway and Dyason. West Australian mining men, however, are not at all eager to keep the Bullfinch scandal alive, so we may hear of a polite refusal to the suggestion of the Victorian Chamber.

General Conditions.—Mining generally just now is dull, apart from Bullfinch. At Bendigo the bright spot is still the Central Red White and Blue claim on the Sheepshead side-line of saddle-reef. The value of the ore keeps high and dividends are most satisfactory. In Victorian alluvial mining, the Cathcart mine furnishes the best returns. The claim was supposed to be worked out, but it is astonishing everyone with its splendid output. New South Wales mining is without revival. Nothing cheerful comes from Great Cobar, where it is not at all certain yet that a Murex plant will be installed. Gold mining is flat, though some of the dredges are doing fairly well. The same thing can be said of gold mining in Queensland. Fortunately there copper mining is getting to the productive stage and the Hampden will have its furnace in full blast this month. Floods have affected Chillagoe and Etheridge by blocking the traffic. West Australian gold mining, like that of Eastern Australia, suffers from the exhaustion of the richer deposits and the absence of any new discoveries. So what with labour, lower yields, and the decline in the price of metals, mining men are not cheerful.

MEXICO.

Mololoa.—The most important transaction of the present year in the State of Jalisco involves one of the famous *antiguas* of Western Mexico. The Mololoa and adjoining properties in the Hostotipaquillo district, with a surface area of 321 acres, have been purchased by Makeever Bros., of New York, who have been operating for several years in the Hostotipaquillo and San Sebastian districts of that State. A reduction plant will be built during the next 12 months. The Mololoa mine was opened



The State of Jalisco, Mexico

by the Cora Indians before the Spanish occupation, and when the Spanish invaders reached Western Mexico its fame was such that Gines Vasquez del Mercado, the Spanish captain sent to pacify the Coras, was disappointed at not finding a mountain of gold and silver. In the 17th century the mine was worked with such success by one Tomas Treviño that the envy of other Spaniards was aroused, and in the hope of getting possession of the Mololoa they accused Treviño before the Holy Inquisition of "practicing diabolical rites." The accusation was based on a system of fire signals arranged by Treviño and a partner for purposes of communication between the Mololoa and mines across the Santiago river, which they also were working. Treviño was taken to Mexico City, tried, convicted, and burned to death in 1645. His partner took

and was then he could hardly, wrecked the workings, and escaped from the country through the port of San Blas. The Mololoa was re-opened, after a long period of idleness, in 1904, and produced much rich ore during the following three years. A fault underground interfered with operations and resulted in changes in ownership. The vein extension was not found until last year. Since then the rich ore-shoot has been re-opened, and for several months high-grade shipments have been made.

San Rafael Anexas.—The annual report of this successful Pachuca company shows that it has produced a total of 32,989,555 pesos, and has paid in dividends 14,162,379 pesos. Operations were commenced in August 1874. In 1910 the company had a production of 3,122,436 pesos, and the dividends totalled 1,528,800 pesos. During the year 92,000 pesos were spent for additional equipment of the new cyanide plant, bringing the total cost of the plant to nearly 800,000 pesos. Owing to the fact that there is now plenty of power for Pachuca operations, the 1911 showing is expected to be much better than that of last year.

Teziutlan.—A Federal court decision, confirmed by the Supreme Court of Mexico, has cleared the Teziutlan Copper Co. of liability under the judgment rendered last year against George D. Barron, at one time prominently identified with the Teziutlan enterprise. The judgment attracted much attention, as it was for 23,059,084 pesos. It resulted from a suit brought by the Compañía Explotadora Mexicana, a concern formed in 1895 by men well known in Mexico to acquire and develop mines in the Teziutlan district of the State of Puebla, and of which Barron was president and general manager. The allegation was made that the company authorized Barron to buy the Aurora and other properties that have since become big copper producers, and that in acquiring the mines he took title in his own name and later transferred them to the Robert S. Towne interests, which control the Teziutlan enterprise. The judgment was based on the earnings of the Teziutlan Co., with interest at 6%. Mr. Towne stated last June that the judgment concerned Barron exclusively, as the company acquired its mines before there was any suit or judgment against him, and that they were held under perfect and unencumbered titles. Such representations were made in subsequent legal action, and the Court held that the Teziutlan Copper Co. was entirely separate from Barron. The

Teziutlan is one of the principal copper concerns of Mexico.

General Conditions.—The decision of President Diaz and Vice President Corral to resign has given hope of early peace in Mexico. While mining operations have been well maintained, considering disturbed conditions and traffic interruptions, the industry has suffered; important plans have been delayed and practically no new capital has entered the Republic. However, the belief is general that with conditions again stable, and proposed reforms effective, there will be greatly increased mining activity. Danger of loss through the depredations of revolutionists and bandits caused the Mexican National Express Co., operating on the National Railways of Mexico, recently to prohibit agents accepting money, bullion, etc., for shipment. The National line between Chihuahua and El Paso, which was the first cut by the rebels, will be quickly repaired in the event of peace. This line, and that of the Mexico Northwestern out of El Paso, are important to the El Paso smelter of the American Smelting & Refining Co., which was forced to shut down several furnaces as a result of the falling off in shipments from Mexico. Southern Pacific bridges in Sonora and Sinaloa have been burned and West Coast traffic is demoralized. Cananea was surrendered to the revolutionists, but there has been no interference with the operations of the Greene-Cananea. Revolutionists are in command of Agua Prieta, the customs port for the Moctezuma Copper Co. and other concerns using the Nacozari railroad. Mines operating beyond Pedracina, on the Torreon-Durango line of the National, have been without shipping facilities for some time, many bridges having been burned. Rebels are in charge of the Velardeña and Asarcocamps of the American Smelters Securities Co., in Durango, but have been maintaining order, and the company has been able to continue operations. Chihuahua has been again cut off from Torreon by the burning of bridges between the two cities, and many bridges on the three National lines eastward out of Torreon. Rebel activity at Mapimi, in Durango, caused the smelter employees of the Peñoles Mining Co. to strike for higher wages, and resulted in a temporary shut-down of the smelter. The Peñoles is controlled by Germans. Pachuca was recently taken, and a night of lawlessness ensued, but order was restored by the rebel leader the following day. If railroad communication, which was cut, is re-established shortly, there probably will be no interruption

of mining and milling in the Pachuca district. There has been no interference with operations in the El Oro district. Bridges on the National line to Guanajuato have been burned, cutting off the Guanajuato district. Property of the Salinas of Mexico, an English concern, was damaged by a rebel band, and Claude Stanhope, the manager, a British subject, was maltreated. Bullion worth 10,000 pesos, was taken from the Bacis Gold & Silver Mining Co., an English concern in Durango, but was later returned by the rebel leaders. The San Carlos Gold Mines, of London, operating in the Mesquital del Oro district of Zacatecas, intends to suspend work

well as Mexican mining concerns in various districts of the Republic.

NEW YORK.

The stock market is rapidly recovering from the sluggish condition into which it fell while waiting for the Supreme Court to decide the anti-trust cases. The Court handed down its decision on May 15; and this being promptly hailed as not inimical to "big business" if honestly conducted, brisk trading began at once, to the extent of 3,650,000 shares within the next week. In the general advance of prices ensuing, the mining stocks shared



PACHUCA, EL EL. ORO

pending settled conditions. Concepcion del Oro, in Zacatecas, was recently taken by revolutionists, but there has been no report of interference with the operations of the Mazapil Copper Co., of Manchester, England. The company's copper smelter is at Concepcion del Oro. The State of Oaxaca is without railroad service, due to rebel activity along the line of the Mexican Southern Railway. The American Smelting & Refining Co. has shut-down several of the furnaces at its Monterey smelter. The coal companies in Coahuila have been forced to curtail operations. Armed bands, some operating as revolutionists and others made up entirely of bandits, have levied on foreign as

handsomely, some of them, such as Miami and Ray, reaching the highest levels they have attained this year, while Anaconda, Federal Mining & Smelting, Goldfield Consolidated, Nevada Consolidated, and the rest of the list recovered most of the ground lost since February.

Industry, as a whole, however, will not for a long time resume the snap and activity to which it was accustomed up to three years ago. The reasons are to be found partly in the uncertainty that still remains in spite of the Standard Oil decision and partly to the unsettled condition of legislation bearing on reciprocity with Canada and other tariff ques-

them. It can be pretty confidently predicted that before the present session of Congress comes to a close, important reductions will be made in the tariff on raw materials as well as on manufactured articles of general necessity. Never, within the memory of the oldest engineers in New York, has so little interest been shown in the development of new mining districts, or of novel methods and processes.

The Standard Oil decision of the Supreme Court, for which the country has been waiting eagerly for some months, was read with mixed feelings; the attorneys for the Government congratulated themselves that the United States had won every contention in the case, while the business interests also derived great satisfaction from the mild and unaggressive tone of the decision. The Company was unanimously affirmed to be guilty of the charges proved against it in the inferior courts and was ordered to dissolve within six months. The case was thereupon re-transmitted to the inferior court with full power to enforce the edicts of the Supreme Court. From later reports, the Standard Oil does not propose to submit meekly to the decision, but it is not at all clear what it can do in the matter. The company will doubtless seek to institute new and more favourable legislation, a procedure with which it has not been at all unfamiliar in the past. While the decision of the Court was unanimously against the contentions of the company, the Chief Justice took occasion to explain that his interpretation of the Sherman Anti-Trust Law was to the effect that only "unreasonable" restriction of trade was forbidden by the Act, the discrimination between reasonable and unreasonable being vested in the courts. Justice Harlan, in a dissenting decision, protested with some emphasis against the seeming assumption of legislative power by the court, and this opinion is quite generally endorsed by leading legislators and business men throughout the country. It certainly does rob the decision of much of its weight, thereby preventing a clear and unequivocal application to future cases in which restraint of trade is sought to be proved.

The copper market offers some encouragement. It is true that production is still large and steadily growing, showing the utility of the unofficial efforts to curtail production by mutual understanding between the producers, but consumption likewise is increasing. It has at last become apparent to the consumers that the price of copper has reached the lowest limit at which mining can be conducted pro-

fitably by most of the companies. It is highly improbable that copper will sell much cheaper than it has been selling for some time, but with supplies beginning to come in from new sources, it is not to be expected that prices will advance for a while. According to data compiled by E. N. Skinner and recently issued by Thompson, Towle & Co., stating particulars in regard to 53 copper-producing companies of America, only 37 are able to earn dividends with copper at 11 cents, while all but five appear to be able to earn dividends with 12 c. copper. It is noticeable on examining the statistics that certain of the 'porphyry' coppers are crowding closely some of the Lake Superior mines in the cost of producing copper. Rumours are current that the Guggenheim, Amalgamated, and Phelps-Dodge interests will shortly combine in the organization of an independent selling agency.

The 'porphyry' or disseminated copper-producers are steadily coming to the front. Miami and Ray have just entered upon regular production, the Nevada and the Utah Consolidated are completing their development and the mines at Morenci are keeping pace. Inspiration will require about two years, and Chino a much longer time, before they begin to yield. Ray is now producing 1000 tons of ore per day, and the Miami output for April was 30,000 tons of ore, averaging, on account of inclusion of considerable low-grade development ore, about 38 lb. copper per ton. During May the production was about 40,000 tons of ore, averaging between 41 and 42 lb. per ton. The mine will soon be able to produce up to the limit for which the plant was designed, 60,000 tons, and by the end of this year will be able to yield, if desired, about 50% more than the designed capacity. As to the cost of producing copper from the 'porphyry' mines, opinion is rather general to the effect that the estimated cost will be exceeded. The policy adopted at Bingham, whereby fully 30% of the copper in the ore is thrown away as part of the price of operating on an enormous scale, while economically reprehensible, can be defended as a business policy as long as the price of copper does not go above 12 cents, but if the price rises, additional effort should be made to restrict the losses in the mill.

The success of the 'porphyry' mines, with the promise of cheap copper, has had a beneficial effect on the management of some of the older and more expensive mines. Anaconda, for example, has never been in better shape physically. No excessive amount of ore is in

reserve, but the lower levels look exceedingly promising. The cost of operation at Anaconda amounts to about 9 c. per lb., and the total, including renewals and some expenses which might properly be charged to capital, does not exceed 10 c. per pound.

Porcupine continues to attract more attention here than any other gold-mining district. The railway has been completed to Frederick House and will be into the camp by July. Anticipating a rush when tourists can go into the camp in Pullman cars, many promoters have this winter driven in over the snow, and some are even now wading through the mud. For the most part they have returned a weary and disgusted lot. Not that the gold is not there, but the opportunities for promoting seem shamefully limited to those who have been wont to look on a flow of language and a printing-press as the most essential possessions of a mining promoter. Canadian laws are more exacting than were those of Nevada when Goldfield was booming, and claim-owners in Canada have also a just appreciation of the possibilities of the situation, whatever may be thought of their estimate of probabilities. The requirement of \$10,000 for a 30-day option that may call for ten times as much at the end of that period, is disconcerting and discouraging, and the selling of reams of stock certificates on the possibility of later securing an option of some sort, is not now as easy as formerly. There is a general feeling that a boom in Porcupine stocks would be easily produced, but, unfortunately for the promoter, mines are now a prerequisite; and the few properties so far developed are all in strong hands. The Dome mine at Porcupine, probably the best-known property in the new district, is owned by the Dome Mines Ltd. This company is capitalized for \$100,000. The control rests with a small group closely affiliated with the International Nickel Company and including J. R. De Lamar, E. R. Converse, A. Monell, W. E. Corey, and E. T. Wood. With them Robert M. Thompson and S. H. P. Pell are said to be associated. An eighth interest is held by W. S. Edwards, in whose behalf Jack Wilson was acting when the discovery was made. Mr. Edwards lives in Chicago, and is a manufacturer of gas and electric fixtures. The extent to which Chicago men have spent money in prospecting in Ontario in recent years is not generally recognized. A number of development syndicates have been financed there and, aside from finds at Porcupine and Cobalt, Chicago men have done well

in iron: the Moose Mountain mine being a case in point. When the value of the Dome mine was appreciated, Mr. Edwards was easily able to interest capital on the basis of one-eighth interest clear, with the further agreement that the mine should be equipped and a mill built this season. After preliminary tests the Merrill Metallurgical Co. of San Francisco undertook to build the mill and, not anticipating the prompt completion of the railway, the machinery was rushed through the shops and shipped over the ice.

Another Porcupine property that has attracted much attention is the Hollinger, owned by the Timmins-McMartin-Dunlap syndicate. The vein is 6 to 8 ft. wide and has been prospected to a depth of 200 ft. A mill-test resulted in a recovery of \$50 per ton. The gold is in part native and in part associated with pyrite in quartz. Recently shares in the company owning this mine have risen rapidly and there has been some suspicion of inside manipulation. It now develops that the real reason for the increase is that cross-cuts through the sericite schist which forms the country-rock, show both foot and hanging walls to be mineralized. Through a zone 100 ft. wide the rock is of "good milling grade," presumably worth \$3 or more per ton. This discovery affords another link in the chain of evidence pointing to a probable future for the district as one of the great low-grade districts of the world.

Comstock mines are doing better this spring than for many years. The energetic work done by Whitman Symmes for the Ward Shaft Pumping Association is bearing fruit. As noted in the letter appearing in your March issue, the 2500-ft. level in the Mexican mine has been recovered and early this year a body of ore 10 ft. wide was found. Driving along the vein has shown that this is both rich and extensive. A rise has also been driven to 2400-ft. level and at the top ore assaying \$100 per ton was found. As the ground for 600 ft. above is untouched, the situation is considered extremely favourable. What may be found below the 2500 ft. level is still unknown, but the ground is to be tested. In the meantime the richer ore is being shipped to smelters and the low-grade accumulated for a mill, which Mr. Symmes has been authorized to build. Naturally this find has stimulated work by the Union and other companies, and indeed there has been a general revival of interest in the Lode. Shares have soared in price, going beyond the legitimate increase warranted by the facts, as is usual, but general conditions have improved.

PERSONAL

L. R. ARCHBOLD is at Numea, New Caledonia.

HOWLAND HANCOCK has resigned from the U.S. Geological Survey and will spend the next six months in South America.

HENRY C. BANON, now living at Che-manus, B.C., left London on May 27.

H. B. BATEMAN has returned to Nigeria.

A. C. BEATTY has opened an office at No. 1 London Wall Buildings.

H. C. BEELER has moved his office to 1004 First National Bank Building, Denver.

J. M. BELL, lately Director of the Geological Survey of New Zealand, is in London and will open an office as consulting geologist.

JOHN M. BOUTWELL, consulting geologist for Phelps, Dodge & Co., is at Pilaes de Nacozari, in Sonora, Mexico.

R. GILMAN BROWN is at Kyshtim.

J. M. CALLOW has been appointed consulting mill engineer to the Inspiration Copper Co., Arizona.

FRANK L. COLE and RUSSELL Y. HANLON have formed a partnership as consulting mining engineers, with offices at Manila.

CHARLES L. CONSTANT has been at Cobalt, Ontario.

CONVIS & COMPANY have opened an office as consulting engineers at Finsbury Court, E.C.

G. S. DUNCAN, representing the Mines Management Co., of New York, is about to open an office in London.

H. W. EDMONDSON has resigned as superintendent for the Rio Plata Mining Co., Mexico, on account of ill health.

PERCY L. FEARN is temporarily at New York, from Costa Rica.

W. B. FISHER, lately at Salt Lake, has gone to New York, entering the service of the American Smelting & Refining Co.

E. MYLES FLYNN, recently at Porcupine, is in London.

ANDRE P. GRIFFITHS has gone to Portugal.

E. C. B. HEDEN is with the Anglo-Newfoundland Development Co., at Millertown, Newfoundland.

C. A. HEUSSLER is in Newfoundland.

LOUIS D. HUNTOON has resigned from the department of mining in Yale University to engage in professional work in Canada.

J. F. KEATINGE, recently manager of the Bundi tin mines, is home from the Malay States.

E. S. KING, formerly at Kalgoorlie, has been appointed manager of the Carn Brea and Tincroft mines, in Cornwall.

BEN B. LAWRENCE is in Alaska.

THOMAS H. LEGGETT is at Kissengen.

HENRY LOCKHART Jun. is here from New York.

JOHN H. LUCAS has left for Peru.

DUNCAN F. MACAULAY has been appointed manager of the Associated mine at Kalgoorlie.

C. H. MACNUTT, general manager for the Poderosa Mining Co., in Chile, is expected in London at the end of June.

T. BRUCE MARRIOTT was recently in Venezuela.

THOMAS MCSORLEY, lately in California, has been appointed mine superintendent of the Atbasar, in Siberia.

HORACE G. NICHOLS has gone to the Urals for the Anglo-Siberian Syndicate.

ARTHUR L. PEARSE is back from a hurried visit to New York.

R. M. RAYMOND was at New York recently, and is now in California.

H. A. RICHARDS has returned to Cornwall from Ashanti.

T. A. RICKARD gave a lecture on 'Mine Valuation' at the Royal School of Mines on May 25.

H. M. RIDGE has returned from Austria.

F. F. SHARPLESS is in British Columbia.

W. E. THORNE left New York on May 4 for Denver.

W. TRURAN is in Brazil.

SCOTT TURNER sailed for New York on June 10.

H. L. TWITE was in Germany during May.

H. H. WEBB will sail from New York for London on June 28.

MORTON WEBBER was recently in eastern Canada.

A. R. WEIGALL, recently in Korea, is now at Sydney, New South Wales.

ROBESON T. WHITE is now general manager for the Braden Copper Co., in Chile.

Among those in London just now are CHARLES BUTTERS, SIDNEY J. JENNINGS, ERNEST LEVY, RICHARD B. STANFORD, JOHN HAYS HAMMOND, and H. F. JULIAN.

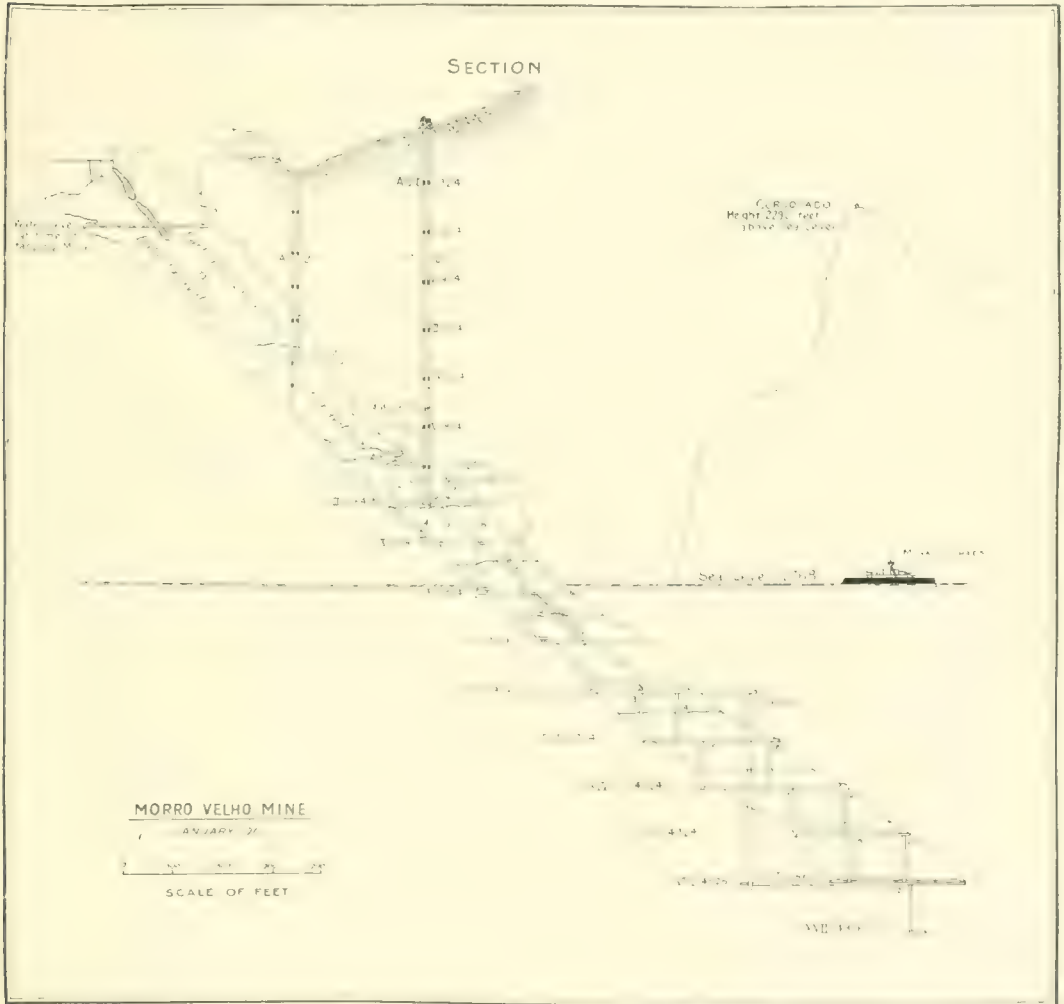
DISCUSSION

Our readers are invited to criticize anything appearing in this magazine and to discuss other subjects of general technical interest.

The Deepest Gold Mine.

Sir—On several occasions of late the *Mining and Scientific Press* and *The Mining Magazine* have contained statements regard-

I had occasion to visit the Morro Velho mine recently, and found it was almost 5000 ft. in depth. I enclose a plan and section of this mine, kindly furnished by Mr. George Chalmers, the superintendent, and corrected to January last. It shows the lowest level 4926 ft. below the collar of the main shaft, and 4602 ft. vertically below the adit. As



ing the deepest gold mine, declaring it to be in the Bendigo district of Victoria.

The issue of the *Mining and Scientific Press* of January 14, on page 103, mentions the Victoria Consolidated as the deepest gold mine, whilst on page 114 of the same issue it gives the first place to the Morro Velho mine of the St. John del Rey Gold Mining Co., stating that the bottom level was 4000 feet vertically below the adit.

the dip of the orebody is roughly 45° , the depth of the mine along the dip is nearly 7000 feet.

H. KILBURN SCOTT.

London, April 17.

[This interesting note was unavoidably held over from our May issue. Such authenticated data are always welcome.—EDITOR.]

Fungus for Fuel.

The Editor:

Sir—I notice on page 37 of your March issue that the "resources in the way of fungus and other vegetable growths" used for fuel in the Chorolque district are exhausted. I noticed a similar reference to a "fungus" being used for fuel in Bolivia in another article, published some months ago by you. And I remember reading a similar reference in the *Engineering and Mining Journal*.

The plant referred to as a "fungus" is undoubtedly 'yareta,' which is thus defined in the Century dictionary.

Yareta [Quichua name], a curious umbelliferous plant, *Azorella glebaria*, of the high table-land of Peru and Bolivia where together with the *taquia*, or llama dung, it is a chief source of fuel.

I well remember my first sight of this plant near Crucero, Peru, where I first saw it through the mists of early morning and at first thought it was half-melted gigantic snowballs. Its growth is so different from ordinary flowering plants that it is hardly a wonder that engineers have not named it correctly.

W. H. SHOCKLEY.

London, May 7.

The Finance of a Mine.

The Editor:

Sir—I have read with a considerable amount of interest the first of what seems likely to prove a valuable series of articles on mining finance by Mr. M. H. Burnham, and while I am not competent to comment on them from the standpoint of the mining engineer, yet I can readily believe that his suggestions are a step in the right direction so far as they are concerned. It is from the standpoint of the mining-share investor that I criticize Mr. Burnham's preliminary article. The first point I want to make is that with the exception perhaps of the leading mines, the information published at present is of such a scanty nature, and in such a form, that it is impossible for an investor to appraise the value of the shares by the formula laid down by Mr. Burnham; secondly, that if the information were supplied, only those investors with some knowledge of mining affairs would be competent to so value them; and thirdly, that it would be difficult, in the case of many base-metal mines, to present information in the matter of ore reserves, on which to form a reliable judgment.

It will, I think, not be disputed, that to fix more or less correctly the yearly contribution

for capital redemption, it is necessary to know the extent of the reserve in a mine, but engineers differ very seriously on the construction they place on the term 'ore reserve.' I gather that Mr. Burnham considers that only ore blocked out on four sides should be classed as 'positive' reserve, and many will agree with him, but this is by no means the general view of mining engineers, and until companies issue plans and sections showing the assay-value of the ground, and indicate how the quantitative calculations were arrived at, how is an outsider to know what reliance can be placed on them? The recent differences as to the quantity and value of the ore in the Golden Horse-Shoe mine between Mr. J. W. Sutherland, its manager, and Mr. Henri Kuss, the French Inspector General of Mines, is a case in point. Therefore it does seem to me that until sections are issued with reports, to enable the investor, capable of so doing, to form his own judgment as to the reasonableness or otherwise of the valuation, it is hopeless to try to work to Mr. Burnham's formula.

Then it is equally important to know the cost per ton of making the product marketable, including the expense of administration, etc. And how many of the companies present their accounts in such a way that an investor can get at these costs? On this point, as is probably well known, the Institution of Mining & Metallurgy has issued a strong recommendation to its members, advocating the general adoption of a standard form of cost-sheet which would give such information. But it must be remembered that the form of presentation of accounts to the shareholders does not rest usually with the engineer, but more often with the secretaries and accountants, and sometimes with the directors.

But assuming that such information were issued, how many investors would be able to profit by it? I venture to assert that the average investor in mining shares has but a perfunctory knowledge of mining conditions, and without some such knowledge, he would be unable to appreciate the difference between reserves blocked out on four sides and ore-bearing ground through which merely a level had been driven, and thus he would be in much the same position as he is now. I, of course, recognize that the investor with some knowledge of mining would be in a far superior position to the present if the information necessary to enable the use of Mr. Burnham's formula were supplied.

And then it seems to me in the case of base-metal mines, where the price of the

metal fluctuates so much, that unless the 'ore reserves' plan indicated also at what price for the particular metal a block of ground was profitable, even the investor with mining knowledge would be in a quandary. Take the case of tin, with which I am more particularly familiar: With present prices for black tin, certain ground might be counted as a 'reserve' which, with a fall in price of say £30 per ton—a not impossible drop, I am sorry to say—would be quite unprofitable, and therefore could not be so classed. And another point in connection with this is that some engineers report chemical, and others vanning-shovel results, between which there is a vast difference when one comes to practical work. In the district with which I am associated—Cornwall—no mining company, so far as I am aware, publishes any statement of ore reserves, not even the premier mine Dolcoath, and I venture to question whether the managers themselves, with perhaps the exception of one or two cases, have any reliable information on the subject.

Finally, I feel too that any general acceptance by investors of the formula laid down would not be to the advantage of the small mine. Many of these are far more remunerative than larger concerns, but few of them have working capital sufficient to lock up in development (or in other words 'ore reserve') for any long period ahead, and it is a moot point whether it is policy in the case of base-metal mines to do so. It would be a thousand pities if such mines became unpopular because they could not show an assured 'life' many years ahead, as is the case with some of the large gold mines. Mr. Burnham may, of course, reply that such concerns do not come within the category of an investment, but anyhow, at present, they represent a large proportion of the capital locked up in mining ventures.

These are a few points that occur to me in reading Mr. Burnham's article, and if he can see his way to deal with them in a future issue, I shall personally be indebted to him.

HAROLD E. FERN.

London, May 23.

Dredging on the Gold Coast.

The Editor:

Sir—The neglected dredging areas of West Africa are well worthy of more serious attention, especially in paddock dredging away from the rivers. The accessible auriferous deposits of the Gold Coast are easily prospected and tested, lying in approximately flat

areas with the gold layers in a series of deposits from a foot below the surface to 12 ft. and up to 40 ft. in depth. Water is abundant at from 3 to 12 ft., while the roots of tropical trees on the dredging ground run along the surface and rarely to any depth. The native in past ages recovered millions in value in gold by washing in his primitive wooden bowl. Surely if he could recover so much, and only down to water-level, by individually washing about 25 bowls per day, or about 500 lb. weight of material, a dredge handling 2500 tons, over fifteen thousand times the weight treated by the native panner, should secure a handsome revenue. I think the heavy style of American dredge with close-connected 12 or 14 cu. ft. buckets would be the most economical pattern to adopt as well as a saving in working expense. Americans are engaged in developing Siberia, and it would pay those of them who are builders of dredgers to pay attention to the Gold Coast colony.

LOUIS P. BOWLER.

Bensu, May 8.

Gold in Granite.

The Editor:

Sir—In your February issue I notice that you refer to the reef worked on the farm Rietfontein, No. 1228, in the Lydenburg district, by a company (known as the Rietfontein (T.C.L.), Limited), recently floated by the Transvaal Consolidated Land & Exploration Company, and that you infer that this is a quartz reef in the dolomite similar to those flat reefs worked by the Transvaal Gold Mining Estates and other companies in the Lydenburg district.

I desire to point out, however, that the Rietfontein reef is actually a vertical reef in the older granite; and, as such, is of some special interest as being the only instance where development to any extent has been carried out on a quartz reef in granite—at any rate in the Transvaal, and, as far as I know, in South Africa.

This reef has been known for many years, but the local prejudice that "no payable reef could be expected to live in granite" prevailed to such an extent that it was never properly prospected until two years ago when work was started on it and gold found to occur at intervals along the outcrop over a distance of 10,000 ft. Subsequent development has fully justified the confidence displayed, and certain well defined shoots have already been located, which led the Chairman to make the

statement the other week that "from the results being obtained today it is now possible to state definitely that we have proved the existence of a payable gold mine here, and it is probable that in a few months time the question of the erection of a 10-stamp battery will be considered."

The importance of this occurrence is considerable when the enormous extent of the older granite—at present wholly unprospected—found in this country is considered, and it might be of interest if some of your correspondents could give experiences of gold-bearing quartz reefs within granite walls in other parts of the world. Personally, I know of no valid argument against the occurrence of gold in such reefs or their persistence in depth as compared with similar reefs in many other formations.

J. JERVIS GARRARD.

Johannesburg, April 18.

Standardization.

The Editor:

Sir—The work of standardizing weights and measures, of defining terms, and of outlining a general system of accounting in mining and metallurgy has been undertaken in England by the Institution of Mining and Metallurgy. Naturally to control such a number of operations as are included in the marketing of metals the standard form must be a skeleton only, with modifications to suit each series of operations. From the papers published on this subject it would appear to have been considered principally from a Witwatersrand point of view, and the base metals have been left in the cold.

The various defects in the methods for reporting or comparing operations solely on a "cost per ton" basis are more noticeable, as the value of a ton of ore becomes subject to rapid changes due to variations in grade and in the price of the metal mined. In determining a basis for calculating the working cost it would seem to be natural to select one upon which the final marketed product, ore or metal, is sold; so that the cost and increased intrinsic value obtained can be followed and compared with previous work through all the operations from mine to market. In this way the recovery from the ore affects the cost in a manner not sufficiently emphasized if we show the "cost per ton" alone.

To prevent the mining of waste or unprofitable lode-matter is the hardest task of the mine superintendent. If, for example, he can be given an idea of the number of units of

copper required to pay expenses in the various operations, he can estimate, after long experience in one mine, whether the ore is profitable to treat further or not. In hand-sorting this is essential.

With gold ores the value can be expressed readily in shillings per ton. The assay-value is not as a rule visible as in copper ores; the latter are also subject to market changes and often those are again complicated by variations in foreign exchange.

Is there any reason why copper should not be quoted in England "per pound" as in the United States? Ores are quoted per unit on the long ton of 2240 pounds or per 22½ lb. copper, whereas if we follow the Institution of Mining and Metallurgy our tons of ore should consist of 2000 pounds.

Moisture is often returned on the assay-sheet in grains per pound avoirdupois; in fact, foreign sellers of ore abandon the account as incomprehensible. They see they are fairly treated, the assays agree, the weights check closely, and the balance is correct, so that perfect confidence is established; but the method of arriving at these results is wrapped in mystery. The American and the German accounts are much easier to follow.

In the case of copper mining we have two distinct classes of work. The one in quantitative and the other qualitative. The first includes the breaking, tramming, and hauling to surface of so many tons of crude ore and the subsequent transport of the various products. The second includes the sorting, concentration, and smelting, these being successful rather from the improved value of the product than from the weight treated.

Any mine superintendent who has contracted for stoping by the ton, car, or skip knows the difficulty of maintaining the grade of the ore produced; and if working costs are criticized and the management judged on the same basis the same difficulty is experienced by mining companies. If unprofitable ore is mined the grade of the whole output drops, the cost per ton mined drops and everyone points with pride to a low cost per ton, but the cost of mining a unit of copper is at best the same while the cost of concentration and smelting is considerably increased. For the mechanical side of the work the cost per ton is a convenient basis. If the grade of ore varies the same cost divided by the percentage of copper contained in the crude ore gives us a good basis for comparison in the cost per unit of copper in ore placed on the dressing-floor. By these two figures we can judge the

work at this stage commercially as well as technically, thereby ascertaining whether we are realizing the values contained in the mine at the greatest profit obtainable throughout.

Generally speaking, once the ore is mined there are three courses open to the miner: (1) To sell the crude ore to local smelters; (2) To concentrate and ship the concentrate to the market; and (3) to smelt the ore or concentrates into matte, blister, or refined copper. In order to determine the expediency of either course apart from the cost per ton we must know the recovery (and loss) entailed by further treatment. If we base our cost of each operation upon the recovered units of copper we are taking the recovery into account, although the loss during treatment can also be shown separately per unit of copper recovered. The treatment of copper recovered in by-products may not lower the smelting costs per ton smelted in such cases as fine, flue-dust, and furnace-bottoms, but when compared with the cost of producing a unit of copper the increased recovery lowers the whole cost including the mining on this basis.

An interesting point in the discussion upon the 'square fathom' in the *South African Mining Journal* was the reference, in comparing the old and the new systems, to the ultimate cost "per ounce of gold" won.

L. C. STUCKEY.

London, April 24.

Cost of Copper.

The Editor:

Sir—In your April number and under the heading 'Review of Mining,' I was much interested to see certain statements regarding some of the newer copper properties in Arizona and New Mexico.

The assertion that the Miami mine has an estimated ore reserve of 40,000,000 tons was rather startling, as supposedly reliable sources of information, viz., the leading mining journals of this country, have always given the reserve at less than half that figure. I do not understand why the writer of that article draws the conclusion that the cost of copper at Miami is conservatively estimated at 9 cents per pound, while in the case of the others the same figure is considered as "highly optimistic." It would lead one to infer that either the conditions for economical production of the metal were more favourable at Miami, or that its management is superior to the others. It is, of course, idle to argue about assumed costs of production, but, in my belief, many

persons will be disappointed if at least two of the newer companies mentioned do not produce copper at least as cheaply as at Miami.

E. P. CRAWFORD.

Santa Rita,

New Mexico, May 17.

[Our correspondent draws attention to an error in our figures. The Miami reserve is estimated at 20,000,000 tons and the prospective output is anticipated to be 40,000,000 pounds of copper per annum. The disseminated copper mines were discussed in our issues of August 1910, and of April 1911.—EDITOR.]

Critical Moisture in Tube-Mill Feed.

The Editor:

Sir—In Mr. John W. Bell's letter of February 28, published in *The Mining Magazine* of April 1911, it is stated that "the percentage of water which should be present in the tube-mill feed is numerically equal to the percentage of voids in the sand inside the mill."

Apparently Mr. Bell is confusing percentage of water in pulp by weight with percentage of voids by volume. Actual experience shows that the coarse grit fed to tube-mills on the Rand occupies about 20 cubic feet to the ton, when settled under water. Taking the specific gravity of the dry material in such a product at 2.67, a ton occupies 12 cubic feet; hence the voids in such a product settled under water occupy 20 cu. ft. less 12, equal to 8 cu. ft. or 40% of the total volume. When however such voids (8 cu. ft.) are filled with water, this water only weighs 0.25 ton, equivalent to 20% of the total weight of sand (1 ton) and water (0.25 ton), or a total weight of 1.25 tons of pulp.

If the pulp fed into the tube-mill contains 40% by weight of moisture, such pulp, on the solid being allowed to settle, would have more than half the water standing above the settled solid. Hence assuming that 40% of moisture is desirable in the pulp fed to a tube-mill, this is greatly in excess of the percentage by weight which is required to fill the voids in the settled sand, and it is not apparent that there is anything more than an accidental coincidence between the desirable proportion by weight of water in a tube-mill feed and the proportion by volume of voids in the settled sand.

It may be added that in practice the desirable proportion of moisture in tube-mill feed is largely dependent upon the tonnage of sand treated, the general rule being that the smaller the sand the lower is the percentage of mois-

ture both permissible and desirable. The apparent reason for this is that with a large tonnage of thick tube-mill feed (say 400 tons solid per day to a mill 22 ft. long by 5½ ft. diam. inside shell) the mill cannot discharge at an adequate rate and consequently becomes over full, so that large masses of sand and pebbles are projected at once instead of the pebbles individually, as would be the case with a more dilute pulp. With a small thick feed (up to 200 tons of solid per day as a pulp containing 27% by weight of moisture) overcrowding of the tube-mill does not take place and more efficient crushing is obtained than with a similar small feed of solid as a more diluted pulp.

WALLFORD R. DOWLING.

Germiston, Transvaal, May 15.

Porcupine.

The Editor:

Sir—I have read with interest the article by Mr. W. J. Loring in the April number of your Magazine. Having just come from Porcupine, where I had the pleasure of meeting Mr. Loring, I beg to submit the following notes.

The first discoveries were made in the summer of 1909, and the Camp was fortunate in having strong financial interests to take hold of some of the best prospects. Among these were the International Nickel group of New York, the Timmins of Cobalt, and a number of other Canadian houses. These people cut roads into the district and brought machinery and supplies with which to carry on developments during the following summer of 1910 when transportation was difficult. The first results were encouraging. However, the work proceeded quietly and the general public was unaware of what was going on. When transportation opened in the winter of 1910 and news of rich discoveries issued from the Camp, a great many mining engineers, promoters, and adventurers came on the scene. By this time, development on some of the claims had reached such a stage that large tonnages of high-grade milling ore were already blocked out.

During the next few months a great many companies were organized in Canada to acquire properties in the district. These flotations were brought out in Toronto and Montreal, and the public contributed generously. To date over 45 companies have been organized to operate in the district, their capital ranging from \$1,000,000 to \$3,000,000, so that their combined capital is over

\$80,000,000. The par value of most of these stocks is \$1 per share, although a few of them are \$5, and the public was invited to participate in the issues at from 10 to 50 cents on the dollar. These companies paid approximately \$9,000,000 in purchase money for their claims and carry about \$6,000,000 cash in their treasuries for development. The claims are nearly all in the township of Tisdale. It is probable that at least another \$10,000,000 has been collected for use in the surrounding townships, and the organization of companies to develop them is now in hand. Practically all the money for Porcupine has been raised in Toronto and Montreal. Lately New York has taken an interest in the district and several companies have been floated with varying success. Public interest in London appears to be awakening to the possibilities of this new goldfield. The apparent apathy on the part of the English public is probably due to the fact that until a short time ago they were not asked to participate; however, the placing of the shares of the Hollinger Gold Mines on the London market and the flotation of a company by Bewick, Moreing & Co. have attracted considerable attention to the district, and a number of the larger mining houses have sent engineers to report.

In May a forest fire destroyed the surface equipment of some of the important mines, notably the Hollinger, and delayed development, but the near completion of the Government railroad will allow additional machinery and supplies to be received without delay.

The discoveries at Porcupine have stimulated prospecting all through the provinces of Ontario and Quebec, and a number of promising discoveries have been made, notably in the Swastika district, about half-way between Cobalt and Porcupine. A number of gold-bearing veins have been discovered. One company—the Swastika Mining Co.—has already carried its development work down to the 200 ft., where the vein is 7 ft. wide and the average value \$15 per ton. In the Cripple Creek district, about 20 miles south-west of Porcupine, some veins have been discovered. This is near the contact of the Keewatin rocks with a granite intrusion.

The prevailing geological formation of the district has been classified by Mr. W. G. Miller, Provincial Geologist of Ontario, as of pre-Cambrian Age, the oldest series, the igneous Keewatin rocks, being the most widely distributed and the one in which all the orebodies occur. Huronian conglomer-

ate, slate, and greywacke occur in patches capping the Keewatin in the eastern part of the township of Tisdale. The veins cut through both the Keewatin and Huronian rocks and their gold content is not affected by the change from one formation to the other. These rocks have been subjected to intense metamorphism along zones, where they have been rendered highly schistose. These zones strike northeast and the more highly mineralized veins are found in them, the veins being parallel and cutting across the lines of schistosity at a slight angle. The whole region having been eroded during the Glacial period, the veins are exposed at a depth at which all of their contained minerals are in their primary state. This feature of the geology of the district has been commented on by most of the engineers who have visited the district as allowing them to assume that there has been no surface enrichment, and that their surface samplings are fairly indicative of the average value of the ore even at a deep horizon.

During the last few months the most important developments have taken place around Pearl lake and the Hollinger part of the Camp. On the Macintyre claim the shaft is now down 95 ft. on a vein 6 to 8 ft. wide, and the ore coming from the shaft is running about \$35 per ton. On the Jupiter claims a vein 4 to 5 ft. wide has been stripped on the surface for a distance of 500 ft. and gold is visible in several places. On the property of the Porcupine Development Co. (Bewick-Moreing) several veins have been uncovered on the three claims east of Pearl lake and south of the Rea Consolidated. One vein now being stripped is 8 ft. wide and shows visible gold on the surface. On the Porcupine Gold Mines Co.'s property (the Vipond) a Nissen stamp is being fed with ore from the west drift on the 100 ft. level; this is averaging about \$40 per ton.

Development on the Hollinger has been temporarily suspended on account of the fire, but the compressor plant will be in operation in a few days, when developments will proceed. Percy A. Robbins, the manager of the Hollinger, in his report on the property states that 200,000 tons of ore has been blocked out, and he recommends the installation of a mill to treat 500 tons per day. Following his suggestions the management has decided to proceed with the erection of a 60-stamp mill in place of the 30-stamp mill, which was partly destroyed by the fire.

At the Dome mine the construction of a

30-stamp mill is being pushed and it should be in operation by October next. On the Rea Consolidated properties the cross-cut from the shaft at the 200 ft. level has cut a vein that carries 5 ft. of \$30 ore. The damage by fire at the Rea was very slight.

E. MILES FLYNN.

London, June 7.

The Revolution in Mexico.

The Editor:

Sir—In the small hours of the morning of May 8, 1911, the inhabitants of the mining town of Concepcion del Oro were awakened out of their sleep by the sound of firing, to find that a band of revolutionists had entered the town and were attacking the prison. The garrison, consisting of a captain of the Federal troops and five soldiers, prepared to defend the town and climbed on to the roof of the prison to return the fire of the rebels. Two of the soldiers were immediately put out of action; some say they were shot by the attackers, others that they were shot by their captain for mutiny. Two of the remaining soldiers proved useless, and the defence was continued by the captain and one man. These two held out for six hours, making it so hot for the rebels that none dared expose himself. Finally the captain was hit, and he fell off the roof into the prison yard, whereupon the mob, sympathizers with the rebels, blew open the door with a charge of dynamite and stoned the still living captain to death. They then proceeded to mutilate his body and empty their revolvers into his mangled remains. After this they dragged his corpse about the streets and finally left him lying naked, a shapeless mass in the middle of the street.

The rebel leader then proceeded to burn all the Government documents and destroy the telegraph office. He took 1300 pesos or £130 of Government taxes and 300 pesos from the Government pawn-shop. Then he asked for recruits, arms, and horses, finally leaving the town with nearly two hundred armed men, as against the 15 that came with him. One or two of the foreigners working in the neighbouring mines managed to keep their horses, but all rifles and ammunition had to be given up. The revolutionists then decamped, having deposed the existing authorities without putting any in their places. Fortunately a few of the better class of Mexicans banded together and kept the peons from ransacking the town, otherwise the consequence might have been serious to all concerned. The rebels stayed in the district

towns. No resistance was offered; in fact, a telephone message saying that they were coming was usually sufficient to make the *rurales*, or military police, surrender themselves and deliver up arms and horses to the revolutionists. Just a week after the capture of Concepcion del Oro, 120 rebels passed through Aranzazu, a mining camp, and the centre of the Mazapil Copper Co.'s mining operations. Various reports as to the true number of the force were afloat, but all doubt was set aside by a saloon-keeper, who said that he had given each man a bottle of beer as he passed through, the total being two cases of 60 bottles each. The rebels were nearly all mounted; some of them had good horses, and we felt sorry for those of our friends whom we knew to be the original owners. The arms varied from the oldest pattern rifle to the newest Mauser with telescopic sights. Some had sabres and we saw here and there the grey felt sombrero, the head-dress of the *rurales*, or the Mexican *gendarmierie*. The captain of the rebels stopped in Aranzazu and appointed 20 men from the people to act as police and keep order: he also issued a command that anyone who sold a glass of intoxicant would be fined from 50 to 100 pesos. He then rode through to Concepcion del Oro and appointed new authorities and police. What happened in this vicinity was probably the same as happened in many another district visited by the revolutionists. The story of the barbarous treatment of the Federal captain serves to show how the dormant cruelty and barbarity of the Mexican peon is aroused when his blood is up. The said captain, so rumour tells us, was a hard man, and is reported to have shot many prisoners with his own hand, but this does not excuse the cruel way in which he was done to death, especially after his plucky and determined defence of the town. With this one exception the rebels have kept law and order, so that mining operations have continued in this district uninterruptedly. Now that peace has been declared let us hope for a bright future for Mexico.

CHARLES R. H. BLYTH.

Zacatecas, May 23.

Contract Labour in Rhodesia.

The Editor:

Sir—In criticizing your article appearing in the February number of the Magazine surely Mr. Mennell cannot mean that contract sinking, driving, and other underground

work is a negligible quantity in Rhodesia. Official returns are required from the mines as to those employed by contractors working on mines, but the figures do not appear in the Labour Bureau Report for December last; hence no accurate estimate of the proportion of the two classes of labour is available. Private recruiting for contractors and the number of contractors with camps more or less full of 'boys,' at work or looking for work, seemed to me to indicate that work was to be had and there is, or there was recently, no shortage of tenders when contracts were to be let.

Again, figures from the last Report, and which were quoted in your editorial in the February issue, indicate that only about 25% of the 'boys' required during the five months ending last November were forthcoming through the agency of the Labour Bureau. The Labour Bureau had much to contend with about this period and the figures referring to unfulfilled requirements are perhaps artificially high, as, in view of the shortage in supplies, demands for a greater number of 'boys' than were actually necessary would in some cases be made in the hope that the proportion of the demand drafted to the mine might approach the actual requirements. There would indeed seem to be room, and welcome, for contractors with their own 'boys.'

The question of prices obtained is to be considered *pari passu* with other matters; if the work is imperative and must be done and contractors obtain a good price and make money, still it may pay a company to have the work done by contract even though, had their own labour been available, they could have carried out the work more cheaply. In such a case, from the mine-owner's point of view, the act of contracting at the price would not be so unfortunate as the necessity to contract at all, and I take it that this is the central point in the remarks made in the article referred to, and which is traversed by Mr. Mennell in his letter. Wherever there are contracts there are contractors who plead losses or who do make losses, and I am sure there are many mining men, old residents in Rhodesia, who are as firmly convinced that contractors make large profits as Mr. Mennell is that contractors' prices are low, and I think that the mining companies that are able, by good staff and organization, to do their own sinking can show that it can be carried out by themselves cheaper than by contract.

H. N. G. COBBE.

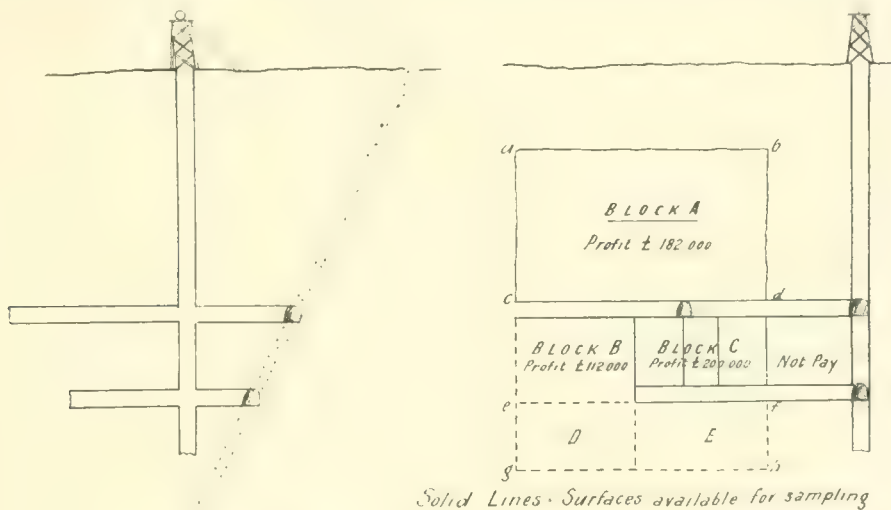
London, June 1.

THE FINANCE OF A MINE. II.

By M. H. BURNHAM.

OF those engineers who specialize in reports not many can have failed to remark the great errors arising from inaccurate block calculations, as observed not only in reports circulated privately, but in

four sides, one is immediately confronted not only with the distance between the sample-sections as determined by the homogeneity of the ore, but with the depth of enrichment perpendicular to the sampled surface. In other



those published by companies, and while an apology is due to the more experienced for the elementary details immediately following, it is hoped that something will be pardoned in an article aiming to interest the general reader as well as the specialist in valuation.

When the calculations refer to a block of ore having the whole vein-width exposed on

words, we can sample, as a rule, but four of six sides of a block, hence we have but a shallow zone on the periphery, the depth of which we are not justified in assuming to be greater than the distance between the sample-sections.

We may say that the ratio of the cubic contents of this zone to that of the block is a

measure of the uncertainty attaching to the result of the above view holds good. From this it will be seen that to be fairly sure of a block, the dimensions may not be greater than the depth of impregnation, as indicated by the intervals between the sections, thus reducing the size of the blocks by an amount impossible in mining practice. For instance: if it were not allowable to take one section more than 20 ft. apart, we would not be justified in spacing levels and winzes more than 40 ft. distant one from the other.

The above view would not seem adequately to cover the ground if we study closely almost any carefully prepared assay-plan wherein the sections are, for example, 5 ft. apart. Here it will be seen that there is a general tendency of the ore found in the shoot, with which alone we are now dealing, to maintain for several intervals a yield, let us say, barely profitable. The next number of sections may be rich, and so on, around the whole periphery of the block. If we colour these plans, it will be seen that in many ore-shoots, at least, there is a tendency of the leaner (or richer) portions to assume a form roughly indicated by Fig. 2, which aims to illustrate such a block of ground. After a little consideration of the principles governing the weighting of data, it will be seen that in order to give the minor areas indicated by (1) (2) (3) and (4) their proper weight in the calculations, the number of sections taken at *b-c* and *g-h* should bear the same ratio to the total number of periphery sections as the areas indicated by the dotted portions bear to the area of the whole block. As will be seen by Fig. 2, however, the distance *b-c* and *g-h* form but a small proportion of the total periphery, that is, areas 2 and 3 are unsampled and fail to affect the mean value of the block as determined by sampling the periphery *a-e-i-k-a*.

If we divide the block as is shown in Fig. 3, it will be seen at once that the minor blocks A, B, C, and D contain each of them a portion of the areas 1, 2, 3, and 4; hence a nearer approximation to the mean value of the whole block is obtained by sub-dividing it, that is, the accuracy varies with the data available, or the risk varies inversely.

Theoretically, of course, complete accuracy is never obtained until the whole block is carefully crushed and treated, the essential principle involved being the same as that governing the quartering of a sample. Inasmuch, however, as this process is so expensive in mining work, it is necessary to make a compromise between the demands of pure

theory and the same when economically weighed, so to speak; expressed otherwise, the exigencies of mining largely determine the distance between levels and connections. Nevertheless, should a preliminary sampling show such variations or patches as are indicated by Fig. 2, it would be either sub-divided or an allowance made approximating it, as a theoretical equivalent. In other words, depending upon a preliminary sampling or upon a judgment based on previous experience with similar ore-shoots, consciously or unconsciously we have to decide upon the dimensions of a standard block, that is, one having a given ratio of periphery to cubic contents.

My own practice is to take sections at 30 ft. intervals, sub-dividing these to as small as 5 ft. if marked variations either in thickness or value are noted in the first series. The great number of sections usually taken is due to an unconscious effort to minimize the tendency of accidentals to vitiate the mean value.

While the demands incidental to winning the ore largely affect the distance between levels, the general habit in vein mining is to space levels about 100 ft. apart, even where this distance could profitably be increased, having reference to the mining cost alone. This spacing of levels is no doubt largely the outcome of generations of experience in the matter of variations in value within the ore-shoot, and in general it may be considered safer to space winzes farther apart than the levels.

It will be apparent that the conditions illustrated by Fig. 2 and 3 are fairly common to tabular deposits, though the shape and size of the lean patches will vary greatly as affected by secondary enrichment and impoverishment, by cross-fissuring, contacts, and a host of other geological factors beyond the scope of the present paper.

Those familiar with the Transvaal will recognize at once, by comparing the shoot conditions found on the Black Reef and Pilgrims with those of the Central Rand, the significance of the different dimensions allowed in the standard block. In parts of the Rand one might feel safe in allowing 500 by 500 ft., and feel doubtful of 50 by 100 ft. in another geological district.

If the necessity for, and significance of, the dimensions of the standard block be seen, it becomes possible to repeat with greater emphasis the contention that:

THE RISK-RATE ("") FOR EACH BLOCK VARIES INVERSELY WITH THE NUMBER OF SAMPLE SECTIONS TAKEN.

For instance: were the dimensions of Block A in Fig. 3 set as a standard when sampled around its whole periphery $a'-c'-o-l'$ at, say, 10 ft. intervals, then the r''' selected would be a corresponding standard value. If, now, Block B were valued and only the surfaces $d'-e'$ and $e'-f'$ sampled, our data would be but one-half that demanded as standard, hence the r''' would be doubled. Again, if only $k-j-i$ were sampled and the dimensions of A be still taken as the standard, then the ratio of the data available to that demanded would be as the distance $k-i$ is to the whole periphery $a-e-i-k$ plus $l-f$ plus $d-j$, and the r''' allowable would be six times that given to the standard block.

From the foregoing it will appear that while there is room for considerable divergence of opinion regarding the dimensions of the standard block applicable to each ore-shoot, a carefully prepared assay-plan often sheds a most illuminating light on this as on other points.

The value to be accorded r''' for the standard block again calls for consideration, and though a multitude of influences affect it theoretically, a low value can usually be given with propriety, especially when dealing with gold properties, though in the case of copper and tin the law indicated by Formula II of the preceding article might be considered.

On the assumption that the dimensions of the standard block have been carefully determined, in the case of a gold property it would appear that a risk-rate of 3% should be sufficient, though this must cover the danger of losses through war, pestilence, famine, theft, strikes, and adverse legislation, all exterior to the mine itself.

In the case of a property similarly situated, the dividends from which are principally dependent upon the sale of silver, a risk-rate of 5% would appear a more reasonable allowance.

As the ore-shoot extension allowable below the deepest level is the source of the greatest doubt regarding the value of a mine, hence the root of most parasitic financial growths, definite criteria of sound finance are impossible without determination of such allowance. A formula expressing the above fundamental principle in simple form applicable to extension of the typical ore-shoot may be written:

Formula IV

$$r''' = P \frac{(1+y) l' + kly}{l'} = \frac{P}{l'} \left[(1+y) \cdot kly \right]$$

where

P = the standard risk-rate.

y = the number of zones or levels below the lowest one proved.

l' = the length of shoot as shown by the lowest level.

k = the number of winzes there should be between two levels in order to make them into standard blocks.

l = the distance between levels on the dip.

Referring to Fig. 2 and assuming that $r-s$ were the shoot length on the lowest level and P were taken at 5%, $l' = 200$ ft. and $l = 100$ ft.

$$r''' = 0.05 \left[\frac{(1+2) 200 + (3) (100) (2)}{200} \right] = 30\%$$

Solving Formula IV we see that

$$l' \left(\frac{r'''}{P} - 1 \right)$$

Formula V y

$$l' + kl$$

or that as the depth increases, the greater the risk (r''') becomes.

Reverting to the last case cited, where it was found necessary to allow a risk-rate of 30% in order to weight the uncertainty attaching to the ground below the last level sampled, it will be seen at once that if our dividends were only 30%, the principle of probabilities as incorporated in the primary theorem would limit the shoot-extension to two levels.

From the foregoing it follows that our old uncertain nomenclature of 'probable ore' is discarded, but that we define the probability in terms of annual interest, that is, it has now an exact financial equivalent.

Among much other practical significance attaching to the same definition of probability is the fact that the ore below the lowest working must be regarded as a reserve, when properly weighted, the same as any other block, but of even greater moment is the fixation of the shoot-extension that may be allowed on a given estimate of dividends to come from that zone.

In order that the above principles be given adequate expression, it is necessary to give greater attention to the effect of deference with reference to determining the present value of each block. Some forty tables have been calculated by the writer to meet these demands, but space precludes their publication here and they will appear later in book form, the philosophy underlying such calculations being there treated mathematically. When dividends are deferred, we may write our basic equation No. 1 as follows:

Formula VI

$$D = r'' + r''' + r'''' + r'''''$$

where D = the average annual dividend
 r = the Consol rate or 3%
 r' = the rate necessary to redeem unit capital in n years

$$R = \frac{r' - 1}{(1 + y)^n}$$

n = the life of the mine in n years
 r'' = the risk-rate
 r''' = the rate necessary to make up the loss of interest during the deferred period.

The present value of one unit of annual payment or C may then be written:

Formula VII

$$C = \frac{1}{r' + r'' + r''' + r''''}$$

which is the basis of the tables.

Returning to the shoot-extension allowable below the deepest level and neglecting for the time being the effect of r'''' , our basic Formula I may be written:

Formula VIII

$$D - r' = r'' + r'''$$

Formula IX

$$D - r' = \frac{r'}{R^n - 1} + \frac{1}{l'} \left[(1 + y) l' + kly \right]$$

which takes into consideration the part of the annual dividend that must be set aside to redeem unit capital in n years, as well as the risk-rate.

Evidently D , the annual dividend, must be on a certain capital, which implies a known crushing plant that in turn determines the life that may be allowed to each zone or distance between levels l , hence n of the above equation can be expressed in terms of y , the number of zones, and be written $k'y$ where k' is the number of years' life allowed to each level.

In the case of going mines where part of the capital has been repaid in dividends from the upper levels in n' years, n of Formula IX may be written:

$n = n' + k'y$ hence Formula IX will become:

Formula X.

$$D - r' = \frac{r'}{R^{n'} - 1} + \frac{1}{l'} \left[1 + y l' + kly \right]$$

As y appears in the exponential form, solutions are obtained by the trial and error method, but it will be seen at a glance that the above simple formula based on the ordinary insurance concept determines the depth to which sound practice may allow shoot-extension. At the same time it takes into consideration such

factors as shoot-length and thickness, the profit per ton and the crushing capacity of the plant, the number of levels already proved and the 'patchiness' of the ground in the ore-shoot.

As will be seen, it demands a greater allowance for shoot-extension in the case of rich than of poor ore-shoots, which also is in accordance with the law of probabilities as touched on in Formula II.

It may be as well to call the casual reader's attention to the fact that the above formula is not a certain prediction of the shoot-extension to be encountered, but is a simple statement of what constitutes sound practice in estimation; as mentioned before, one may successfully wager ten to one that the ace of hearts will be the first card in a pack, but another may question the wisdom of the hazard as of the man taking such chances.

The next paper will deal with the significance of the 'possible' ore lying below the shoot-extension for which only by the above theory we may pay, and the price per unit of economic ore-shoot will there be compared with other purchases made in recent years, with the hope of establishing some standard of accuracy, some measure of financial stability: of inciting to sounder judgment: of indicating the significance of company construction, and, above all, of furnishing some means of gauging the ability of responsible engineers.

Coal in Kent.—The Institution of Mining Engineers paid a visit to the Kent coalfield during the Whitsuntide holidays, and made a close examination of the work done by the Kent Coal Concessions, of which Arthur Burr is director and Malcolm Burr engineer. Numerous borings have cut the Coal Measures at depths from 1300 ft. to 2500 ft. below the surface, and nine workable seams have been found, the latest one being over 13 ft. thick. Shafts were commenced some years ago at Snowdown and Tilmanstone. The overlying strata contain much water, especially in the chalk and greensand, and progress is accordingly hindered. Much money has been spent, and incredulity is often expressed as to the outcome of these ventures. Undoubtedly the coal is there, in a basin twenty miles by ten, situated between Dover and Canterbury, and probably the deposits are continuous with those across the Channel in France. The question is whether the work can be done sufficiently cheaply to compete with water-borne coal from Wales and Northumberland.

MINE SALTING

By T. LANE CARTER.

IN some parts of the world the practice of 'salting' a mine is considered a heinous offence, and is seldom practiced; in others it is looked upon as a joke, and is common. Having had experience in countries where the engineer has no fear of his samples being artificially enriched, as well as in places where he dare not allow the samples out of his sight, for fear of 'salting,' permit me to record some of the facts that have come to my notice.

In the first place the trickster who tampers with samples does not always succeed. Some time ago, a young man with a fine tenor voice was sent to examine a placer deposit in a Western State. He had learned how to pan in a drug-store, and having read a great deal about the wiles of the mine vendor, he went to the property on his guard. The owners had 'salted' several pits they had dug, and when the victim appeared they considered him "dead easy." But when the examiner told them to go off hunting for the day as he wished to dig his own pits and take his own samples, they were more surprised than pleased. Next day when the examiner took his samples to the river he allowed the men to go to the stream to see him pan, as he considered all danger past. As he washed the material the men showed the utmost eagerness to see what would be disclosed in the pan, and while one distracted the examiner's attention for a second the other dexterously slipped a little gold dust into the pan. This they did ten times. At last the young man arose and said, "Gentlemen, I regret to state that your mine is worthless, as there is no gold in the samples." He had washed out the gold from each pan along with the black sand!

On the whole South Africa has been peculiarly free from the scandals of mine salting. Some cases occurred, however, in the early days. In one instance a core from a rich drill-hole on the Robinson mine was substituted for a piece of 'reef' from a hole on the Rand. Fortunately the fraud was exposed in time. At another time it is reported that a small company started up a 10-stamp mill, the shares having been well boomed. In this case the owners salted themselves, and gave out a high figure per ton. After the mill had run for a fortnight, no gold appeared on the plates. In order to keep up the market it was

necessary to turn out a bar of gold. Handing the assayer £800 in gold, which was withdrawn from the bank, they told him to run it down in bar form. In a few hours time he appeared with the bar, but they found it was only worth £500. They asked what had become of the £300. The assayer stated that he had kept it as his commission for silence! He was sure it was worth £300 not to expose them.

In diamond mining there have been cases of salting. In one instance the engineer was so expert in the determination of stones that he immediately saw that the diamonds came from another locality miles away. This observation saved him.

Many cases of salting have occurred in Australia. A friend of mine was saved from a serious mishap once, in that country, by the merest accident. He had taken 150 samples from a mine and after quartering them down, had brought them to an assay-office several hundred miles from the mine. They all assayed high in gold, far better than he expected. He was pleased to be able to make a satisfactory report. During the night it occurred to him that he had taken a sample of waste rock, but he did not remember any assay that ran low in gold. Getting up he looked at his list and found that the sample marked "waste rock" assayed the highest of all. Then he got out all the crushed samples, and boiled each one for 15 minutes in water. After this process he assayed the samples and found that instead of averaging 40 shillings per ton, the average was 4s. The hot water had extracted the chloride of gold that had surreptitiously been placed in the samples, leaving the original gold content behind.

Whether Australia or America has the dishonour of inventing the scheme of placing gold-dust in a cigarette and accidentally dropping the ashes in the pan while an engineer is panning, I do not know. It is certain, however, that this method has often been practiced.

Some outrageous cases of mine salting have been perpetrated in the Western States. For example: The utmost care was taken, for weeks before the examination was made, to prepare the mine. Gold was shot into the rock with a gun, picked ore was placed in a

employed to fool the engineer. Had he not known this, the mine would have been reported as fabulously rich, when in reality it was of little value. I know of another instance in Arizona not many months ago. It was a placer. One of the owners living in the town near-by succeeded in salting the first three samples of the engineer. From his study of the formation the engineer was convinced that any gold found must have travelled a long way and would therefore be rounded and water worn. The particles of gold when viewed under a magnifying glass were extremely angular and the engineer knew at once that the gold could not have come from an alluvial deposit. Selection is necessary in the display of righteous indignation after one suspects that the owners are trying to salt the mine or the samples. I knew of one engineer who once made an examination in a lawless community and who became so infuriated when he found out the tactics used that he denounced in the most vehement manner the whole camp. He was escorted out! Another engineer, who remembered the scriptural injunction to be as wise as a serpent and as harmless as a dove, adopted another method. He soon discovered that the 'crowd' were trying to 'do' him. Apparently he fell completely into the trap set for him, writing down carefully all their data about the value of the mine, working costs, etc., and deliberately taking the largest samples from the salted spots. The owners were highly pleased and pronounced him the most obliging expert in the world. At night, the engineer would slip into the tunnel not far from his room, and sample the mine. He promised the owners to send them a copy of his report; and he did. It was the briefest on record and was as follows: "The average value of the ore in this mine is \$3.05 and it will cost \$7.95 per ton to work the mine. It is not worth a dam!"

Recently in Mexico a case of wholesale salting of a silver-gold mine came to my attention, illustrating how a good habit in sampling often saves a man. Along the hanging wall in certain parts of the mine there is a narrow seam of soft ore, which assays from 1000 to 4000 oz. silver per ton. Three weeks before the examining engineer came from the States to inspect the property, the owner commenced digging out this rich material, putting it into a sack. Then he skilfully covered up his marks, and taking this rich stuff he smeared it over every spot where he thought the engineer would take a sample. So well did he

carry out the work that the engineer never suspected the trick played on him. On his arrival at the mine the Mexican owner gave the engineer two natives to assist him with the sampling. The engineer was unaccompanied by an assistant and realized that great diligence was necessary on his part. Whenever he took a sample he noticed that the natives showed much haste in their endeavour to catch the first fragments broken. From force of habit he cleaned down all loose rock before he took the sample. Not once did he allow the samples out of his sight. Thus the engineer defeated the attempt. The average was satisfactory and he bought the mine. Many months later after a mill had been erected and at work on the property for some time, the same engineer was talking one day with the Mexican who was the former owner. They had become good friends. Said the engineer: "I feel rather proud of the results obtained on the mine. My sampling called for a return of 46 oz. per ton of silver, and we are extracting 42 oz. That's a close estimate." The Mexican laughed and then said: "*Mi amigo*, you deserve much praise for coming so close to the truth. For three weeks before your arrival I worked hard at salting the mine, but you escaped all contamination." The Mexican looked upon the episode as a huge joke. To him there was no crime in tampering with samples. In fact, every miner in the district was educated in the art of salting a mine.

I have known cases where cart-loads of gold-bearing material would be taken to a hole in the ground to make a promising dump of high-grade rock. Then the hole would fill up with water, and this material be pointed out as a sample of the ore below.

The use of the pan may aid the detection of fraud. Obviously one way to determine if a placer has been salted is to pan down the samples and observe the character of the gold. Similarly, an attempt to salt a copper mine was once frustrated by the use of the pan. By washing a few samples the engineer was struck by the peculiar character of the copper carbonate. This aroused his suspicions and he found that some of this material had been slipped into his samples.

It might be inferred that when an engineer goes to examine a property he must always fall into the hands of thieves. This, of course, is not so. In the majority of cases there is no attempt at fraud. The chances of being salted are much less today than in former years, but as long as there is the slightest danger, the engineer must take every precaution possible

THE CHINA-CLAY INDUSTRY OF CORNWALL

By J. H. COLLINS.

TRAVELLERS by the Great Western Railway, before reaching Plymouth, and again after passing over the tree-tops in the deep valleys about Liskeard, often observe

rivers of milk. The whiteness of these streams is due to the presence of suspended particles of clay and mica, the refuse overflow from the clay works situated in the hills near by. Not-



REMOVING SAND AND STONES FROM A CHINA-CLAY PIT

truckloads of peculiar white clay or white stone occupying the sidings, and are especially struck with the whiteness of the streams crossed by the railway, which closely resemble

withstanding the apparent opacity of these waters I have seen trout 8 or 9 inches long taken from them. Moreover, horses and cattle will generally drink this water if permitted

in preference to clear water. Naturally the travellers begin to ask what is the meaning of this phenomenon, and the writer has often been amused by the gravity with which some fellow-traveller, who seems to think it disgraceful to confess ignorance on any subject whatever, vaguely talks of lime or more boldly of chalk. Perhaps some native happens to be present who politely assures the last speaker that he is in error; that neither chalk nor lime is present in any form; and that the peculiar whiteness is caused by a refuse product from china-clay works in the vicinity. This usually settles the question unless the querist happens to be inquisitive or persistent. In such case he soon finds that even the native is usually entirely ignorant of the origin of the material, the extent of the works, the methods of working, and the uses of the products; and if this is true of the intelligent native still more is it true of the general public. Out of Cornwall it is a rare chance to find either commercial men, or until lately even scientific geologists, who have any knowledge of the peculiar conditions of this industry which, next to agriculture and tin mining, is by far the most important in the whole of Cornwall and Devon. The object of this paper is to describe the salient features of this industry.

It is pretty generally known that 'china' was first brought by the Portuguese from China, hence the name. It was called by them 'porcellana,' because it was supposed to be fabricated from sea shells, hence the term 'porcelain.' No real knowledge of the materials used existed in Europe until the publication of the reports of the Jesuit father D'Entrecolles in 1712 and of Count Réaumur in 1729. These reports soon led to the establishment of the porcelain factories of Sevres, Dresden, and Plymouth, the last named having been established in 1733. Up to 1745 the finer materials used in the Plymouth works were imported, but soon after that time Wm. Cookworthy, the founder of the works, discovered 'caulin' or 'kaolin' (which he called 'growan clay,' now china clay), and the 'petuptze' (called by him 'soft growan' and now known as china stone), similar or identical with that used by the Chinese, in great abundance and in several parts of Cornwall. After keeping the secret as long as he could, he, in the year 1768 and in conjunction with Lord Camelford, took out a patent for the use of these materials. How these materials are now employed in the manufacture of porcelain, 'stone china,' and earthenware, in paper making, bleaching of calico and

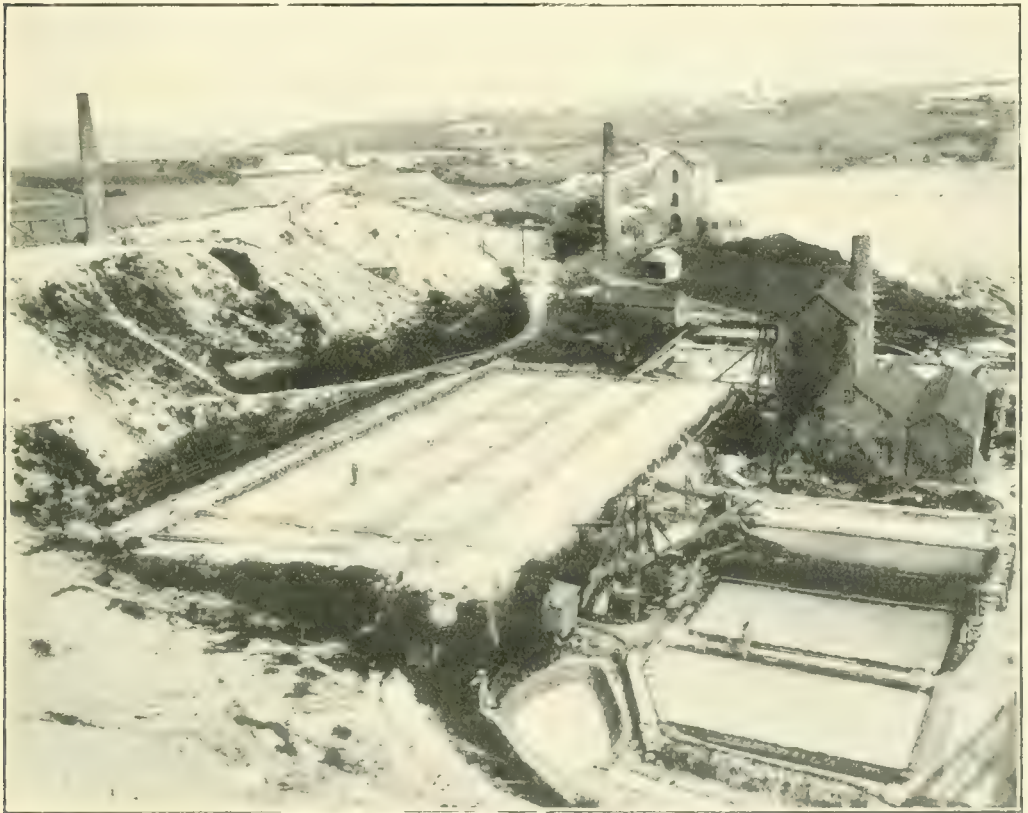
other British manufactures cannot now be described. Nor can anything be said here as to the origin of the material except that both china-clay and china-stone are much altered granite. The object of the present paper is to describe their modes of occurrence and to give a general outline of the method employed in preparing them. The china-clay rock, from which china-clay is prepared by washing, is a peculiarly white decomposed granite which occurs very largely on Lee Moor in Devon, around Hensbarrow in Cornwall, and less abundantly in many other parts of the two western counties. This rock which was long ago named 'carclazte' is simply a granite composed mainly of white or pale smoky quartz, white mica (lepidolite or muscovite), sometimes a little greenish yellow mica (gibbertite), and white or very pale pink felspar (orthoclase mostly); the felspar has been partly or completely changed into kaolin by natural agencies. This modification of granite occurs in areas of irregular form, generally much elongated in one direction, and extending to an unknown depth. It is universally associated with quartzose and schorlaceous veins, evidently of later origin than the rock itself, sometimes too with veins of greisen (a rock composed of quartz and mica), containing oxide of tin. The greatest extension of the decomposed granite coincides with the 'run' or 'bearing' of these veins, and the decomposition is found to be more complete as the veins are followed downwards. Many of the so-called deposits of clay-rock extend for a quarter of a mile, half a mile, or even more in the direction of the veins, while their breadth may be only a few inches and seldom exceeds a few fathoms. It is true that very wide masses of china-clay are wrought in many places, but these are invariably associated with groups of more or less parallel veins. The clay-rock is usually covered by a layer from 4 to 30 ft. thick of brown or yellow sandy or clayey earth, often full of angular pieces of hard granite, granular schorl-rock, tourmaline-schist, with sometimes a little oxide of tin. This is the 'overburden' and it must be removed before the clay can be worked.

Prospecting is a simple operation. It is sometimes done by boring, but far more generally by sinking pits through the overburden, the result of which may be seen in a general view of the Retew district for which and for several other views of interest I am indebted to my friend Mr. Jos. M. Coon, of Morwenna, St. Austell. A gentle depression, called locally 'a slad,' is often a useful guide

to the prospector who naturally desires to avoid sinking pits over hard granite.

The existence of a sufficiently extensive and promising bed of clay, free or nearly so from iron stains, being ascertained, the next operation is to remove the overburden over a considerable area. This is ordinarily done in the manner shown in the illustration, but occasionally by the use of a steam navvy. For the use of this and some other very interesting illustrations I have to thank the West of England China-Clay Co., Ltd.

(a 'button-hole launder') is placed; the rise is filled in and 'washing' may be at once commenced; and as the 'bottoms' are deepened the top of the launder is cut off and the clay 'wash' drained off by the button-hole launder. When the clay ground is found high up in a hill-side so that a main adit may be driven in at the required depth some detailed alterations in the mode of working, especially in the disposal of the debris may be usefully adopted, but the usual method of opening the bottoms is as here described.



MICAS AND SPLITTING-PITS AT TRETHOSA.

While the clay ground is being uncovered it is usual to sink the main shaft to the depth determined upon, usually from 20 to 40 fathoms. This is sunk as near the clay ground as possible, but in firm ground so as to lessen the cost of timbering. It need not be very large as it has only to afford room for a pump-column and ladder way. A cross-cut is next driven from the bottom of the shaft and a temporary rise is put up through the soft clay ground. In this a strong wooden launder provided with holes covered with removable slats

The pump being ready and sufficient overburden been removed, washing may be begun. The decomposed clay ground is broken up with 'dubbers' (a sort of broad-ended pick of great strength); a stream of water is led over this and after depositing all sand, stones, and coarse gritty particles in a 'sand-pit,' it flows down the launder and through the cross-cut into the pump sump, whence it is raised to the surface for purification in the 'micas,' settlement in pits or tanks, and drying.

The bottoms must be kept free of stones

and sand, generally this has to be drawn to surface up an incline and piled. Small winding engines and self-tipping wagons are usually employed for this work, the importance of which is indicated by the fact that for each ton of clay produced, from 6 to 8 tons of sand have to be brought to the surface except in the rare instances when it can be run out through an adit and tipped into a valley.

The clay stream as it leaves the pump-outlet at surface always brings up with it many particles of fine sand and coarse and fine mica all of which must be removed before it is fit for the market. The milky stream is made to flow through a series of shallow channels ingeniously provided with check floats and with outlets for the settlement of particles of mica and sand, that can be opened or closed at will. The stream is gradually spread over increasing areas, so as more and more to check its flow, and when sufficiently refined it flows on to the settlement tanks. A series of these micas shown in the illustration is employed in the Trethosa works of the West of England Co. The arrangements made for drawing off the mica and fine sand or settlement which is deposited in the 'drags' and 'micas,' here and in many other clay works, are such that this once refuse material can be again 'refined' and yields a good deal of 'mica clay,' which is readily saleable at a low price.

For the purpose of drying the clay, the refined clay stream from the 'micas' is generally run into deep (often circular) pits, for settlement and thickening, the overflow water being sometimes led back into the sump or over the clay stopes ('repeating the water'), and sometimes allowed to flow down the valleys as waste water, carrying with it a good deal of the refuse mica and fine sand rejected from the drags, hence the milkiness noted by the tourist.

The lovely blue colour assumed by the water in these settling pits, should it by chance be left long undisturbed, is an effect of light dispersion due to the extreme fineness of the last white particles retained in suspension rather than to any colouring medium employed in the washing, although such medium is used in some works for the purpose of correcting an undue yellow tint in the clay. The thickened clay from the settling pits was formerly, and where sufficient level ground was available, run into shallow 'pans' excavated in the open ground. These were carefully levelled at bottom and strewn with a thick coating of refuse sand. It was there left until sufficient evaporation

had taken place to leave the clay in a state to be cut in blocks. These were laid on the ground, or 'better' piled on shelves in open sheds, where in good weather they soon became dry enough for exportation. This 'shed-piling' and the subsequent cleaning of the lumps by scraping was always done by women or children. The air-drying process is still carried out in a few works, and where the somewhat rare local conditions are favourable is found to be considerably cheaper than the ordinary fire-drying in kilns.

In drying by heat, the kiln or 'dry,' a long imposing looking building with a high stack is usually built beside the tanks, which are generally about 6 ft. deep, so that the settled clay may be trammed directly on to the 'bridge' which traverses the long fire-clay tiled 'pan' of the 'dry,' beneath which the hot products of combustion from the fires pass in their way to the 'stack.' From the bridge the clay pulp is tipped on to the pan in a layer from 8 to 12 inches in thickness. These 'drys' are very long, often 150 ft. or more, the object being, of course, to utilize the heat of the fires as much as possible in drying the clay by evaporation above and by aspiration or absorption through the porous tiles. The large quantities of steam seen escaping by the stack are an evidence of the value of the porosity of the tiles.

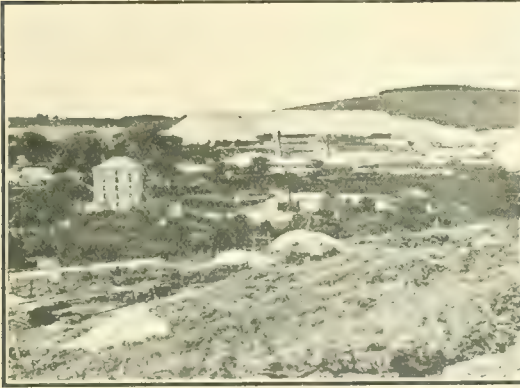
In many cases of late the 'drys' have been built beside a railway siding, as at Burngullow, or even close to the shipping station, as at Charlestown, in order to lessen the cost of transit. In such cases the settled clay from the tanks, while still in a creamy condition, is made to flow through earthenware pipes to the distant 'dry' for a mile or more. The illustration shows a modern 'dry' which has been fitted with shelves for air-drying, so combining some of the advantages of both of these methods. In the numerous cases where the clay is still dried at a distance from the railway siding or shipping port, it is loaded from the 'linhay' into wagons in bulk, or else, and particularly for the foreign market, packed in bags or in barrels for transport.

China stone, or petuntzite, may be roughly spoken of as an immature china-clay rock (carclazyte) in which there is usually a good deal of fluor-spar, some topaz, and preferably no schorl or dark mica. It is quarried in the ordinary way by drilling and wedging, or blasting, then chipped with axes to remove the discolorations which are often found in the joints, and shipped mostly in bulk and in lumps. Some of it, however, is ground in mills provided with chert runners, the ground

material having been run through 'drags' to allow of the settlement of heavy foreign bodies; it is then dried, barrelled, and sent to the potteries, where it is employed, after regrinding with flint, felspar, burnt bone, and other in-

forms of adulteration which are still regarded as legitimate forms of competition.

The china clay industry is not one calling for large outlay in the first instance; a few thousands of pounds well applied and in a



Retrie Clay District.



Transporting Clay in Casks.

gredients, chiefly as a constituent of the pottery glazes.

The original use of china clay was for making fine pottery only (china or porcelain); it is now largely used in various semi-chinas, stone-chinas, granite ware, and the like, and to some extent for the glazing thereof. China clay is also

suitable situation will suffice for the installment of works on a considerable scale. Thus works capable of an annual output of 4000 to 15,000 tons of clay have been brought into operation by expenditures of from £4000 to £10,000. The costs of production per ton of finished clay mostly fall within the following limits:



Drying China Clay in Sheds.



Breaking and Washing Clay.

largely used in paper making, calico 'bleaching,' and the manufacture of sulphate of alumina and many other chemicals; also it forms a basis for many fire-resisting compositions, and it is a most useful ally in many of those

Rent and overburden and ad valorem duty	1s. to 2s. 6d.
Breaking and washing the clay and pumping to surface when necessary	3s. to 5s. 6d.
Drying	2s. to 3s. 6d.
Rents, rates, and taxes	6d. to 1s. 3d.
Royalties	6d. to 4s. 6d.

It is clear, indeed, that all or most of the lowest or highest figures here given will prevail in any one clay works. Where facilities for working are greater, or where the quality of the clay is exceptionally good, there will always be a tendency to the exaction of high dues, involving also higher rate charges. But as a general conclusion it may be said that the total costs at the works, including royalties, will vary from 9s. to 12s. for inferior clays, and from 15s. to 18s. for superior clays, to which must be added the costs of transit to the shipping port and of putting on board, and those of packing in barrels or bags when such is required. There must, of course, be a combination of favourable conditions to secure such results as those given above; overburden not too thick; workable area not too small;

higher and higher. As the clay is almost invariably best in the bottom of the pits, the landlords are rightly unwilling to have the old 'bottoms' filled up. There are many works now where for every ton of clay produced 12 tons of debris have to be raised and piled for a hundred or more feet, and this necessarily on continually diminishing areas. Much of the material makes excellent brick and concrete, but the local demand is insignificant, so that it is becoming a problem of the near future how best to deal with such enormous and rapidly increasing accumulations.

In the decades from 1801 to 1900 the production of china-clay (and latterly of stone) increased from a yearly average of 3000 to 498,800 tons; the annual production since 1900 is shown in the accompanying table.

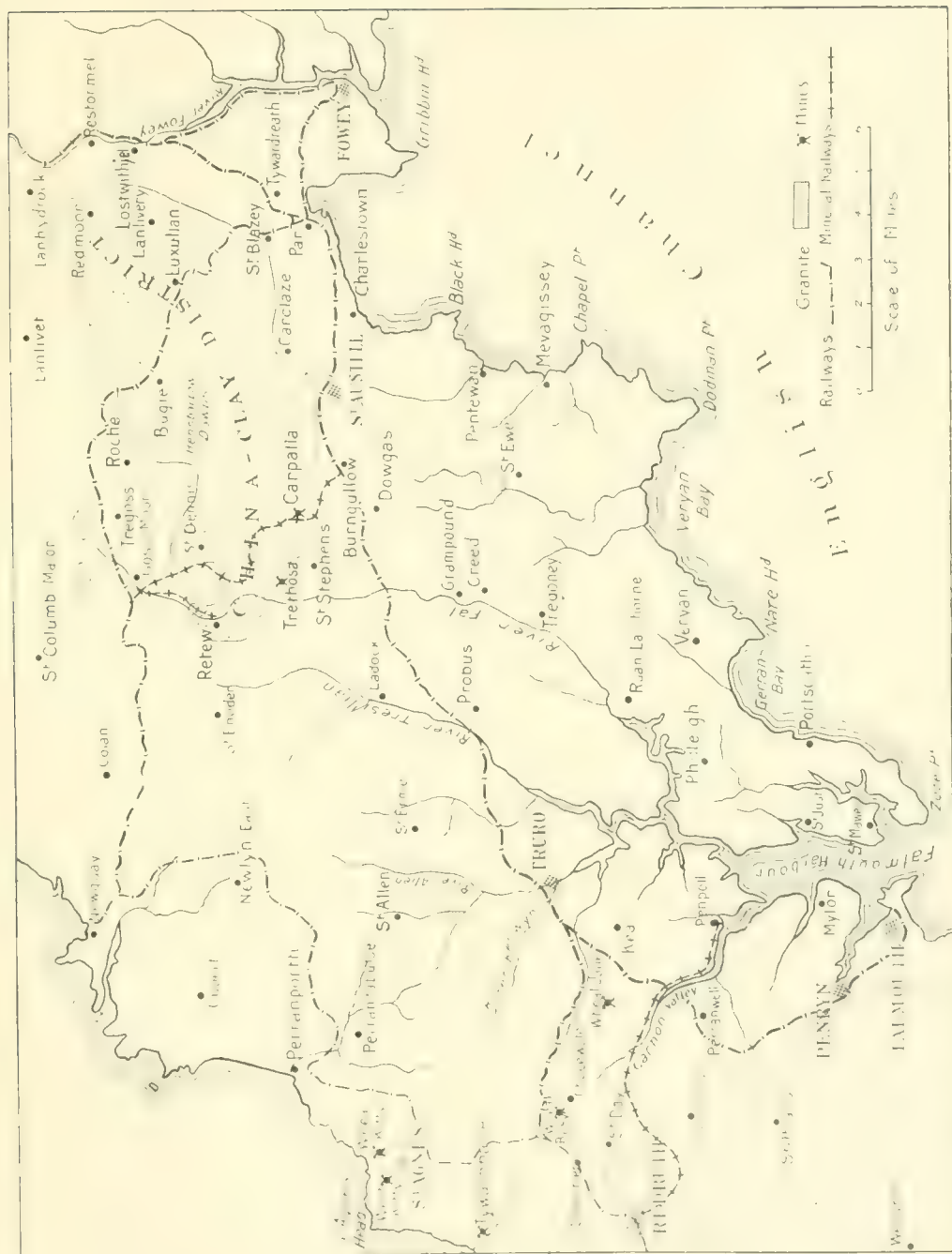
PRODUCTION OF CHINA-CLAY IN CORNWALL.

	China Clay	Mica Clay	China Stone	Total	Value
	Tons	Tons	Tons	Tons	£
1901	517,568	3,165	59,923	580,656	358,650
1902	546,014	8,542	57,882	612,438	410,290
1903	546,392	13,197	53,680	613,269	389,491
1904	583,984	7,140	66,994	658,118	413,044
1905	629,160	11,640	52,171	692,971	456,515
1906	656,017	11,384	57,174	724,575	464,312
1907	714,437	14,615	68,174	797,226	519,440
1908	721,416	21,161	75,473	818,050	529,981
1909	710,380	23,927	56,028	790,335	514,330

clay bodies not too sandy or stony; rents, royalties, rates, and taxes moderate; cheap and effective labour; a sufficient water supply to compensate for evaporation and other losses; fuel at moderate rates; convenient ground for storing debris; shipping ports not too distant, etc. Except in one or two particulars these combined conditions obtain over a considerable part of the West of England better, perhaps, than in any other known region, at any rate outside the Chinese Empire. Already, however, what has been to a large extent and for many years pretty much a West of England monopoly, is being threatened from various quarters. It remains to be seen what will be the result, as import duties against us become more generally imposed and progressively increased.

There is one difficulty now being felt, and in an increasing degree, in several of our best china-clay centres. I refer to the enormous accumulations of debris which are being piled

The Hulton Colliery Disaster.—A report on this explosion, which took place on December 21 last, has been made by R. A. S. Redmayne, Chief Inspector of Mines, and is now issued as a Government Blue-Book. It describes the mine, the method of working and ventilation, and the provision of rescue apparatus, and gives a detailed account of the evidence as to what happened. It appears that in places the roof is liable to be loose, and falls are not infrequent. He is of opinion that the accident happened while a party of men was engaged removing fallen coal, and that in all probability a second fall occurred while they were thus occupied. The seam is notoriously gassy. A lamp may have become overheated, or a fall of coal may have broken one of them, and thus set fire to the gas. Mr. Redmayne considers that the company was understaffed, for the general manager of the company was not only the mining engineer as well, but he was manager of each individual pit.



III. CHINESE INSTITUTE OF TECHNOLOGY

BEGINNINGS OF CYANIDATION

By J. McCOMBIE.

ALTHOUGH the cyanide process was born in Glasgow, it was cradled, reared and brought to an advanced stage of perfection at Karangahake, in New Zealand where it was in full operation for nearly a year before being adopted anywhere else. To the Crown Mines company belongs the honour of introducing this process, in a practical way, to the mining world, early in the year 1889, and almost immediately after its discovery by John S. MacArthur and his colleague, R. W. Forrest. It was brought about in this way: Thomas Melville, an old Auckland resident, floated the Crown Mines company in Glasgow, and some of the ore, which he took home for flotation purposes, was treated by the embryo cyanide process, with highly satisfactory results. Arrangements were then entered into with the MacArthur-Forrest people to build a plant and treat Crown ore at the mine. Pursuant to certain conditions a staff was sent direct to the mine from the experimental plant, the names of these being:

John McConnell (Manager),
Frederick Smeaton (Assayer),
James Tegart (Cyanider),
William Dempster (Engineer),
Peter McFarlane (Carpenter).

All of them are now dead. I give the names of these men here because there is a strong disposition on the goldfields of the Auckland province to belittle the pioneers in every branch of the mining industry, and to relegate such men to obscurity.

Owing chiefly to want of road accommodation for the transport of machinery, there was a long delay attendant upon the completion of the treatment plant at the Crown mine, and a small plant was erected in the Woodstock furnace-house, in consequence. This plant comprised one stone-breaker, one Lamberton mill for dry crushing, two vats, fitted with mechanical agitators, one stock-solution vat, one sump-vat, one filter-press, and four small barrel-towers, for precipitation purposes. Briefly, the process was fine grinding, agitation, filter-pressing, and precipitating on zinc shaving. The first parcel of ore treated was taken from the Maria lode in the Kenilworth mine, of which I was then part-owner and manager, and which is now included in the Talisman company's property. The plant was started early in the month of June 1889, and I have now before me a copy of the first

treatment sheet, which records the value of ore before treatment, as follows:

Gold	24	0	0
Silver	2	1	0

Total value per ton	25	1	0
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Recovery, Gold, 89.2%; Silver, 70.9%.

The strength of solution used was 0.5%, and the consumption of cyanide was 4 lb. per ton of ore treated.

After a series of experiments with both wet and dry crushing, it was decided to adopt dry crushing, using Lamberton mills. The ore was treated by upward percolation, with subsequent water washes, pulled through each charge by means of vacuum pumps. This simple process more than realized expectations in the case of the Crown ore, and it was generally adopted throughout the Dominion, where it remained in use in a good many mills for several years. As depth was attained in the mines the ore became more refractory, resulting in a high percentage of soluble sulphates being formed in the drying furnaces or kilns, and the consumption of cyanide became a serious item in the cost of treatment. Then mill after mill went in for wet crushing, with a dilute solution of cyanide in the mortar boxes, and the first man to give the new departure a practical test, with 20 stamps, was H. H. Adams, at Waiorongamai. Except in the case of the Crown Mines company the system was not continued, and the process gradually veered round to ordinary wet crushing, amalgamation, concentration, and hydraulic classification, followed up by percolation for the sand, with agitation and decantation for the slime.

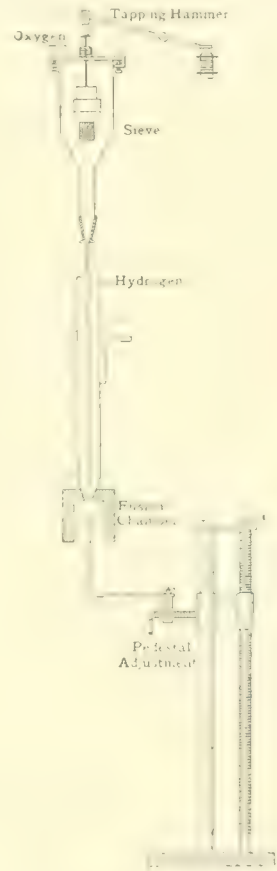
This brings the history of ore treatment by the cyanide process up to date, when decantation is being rapidly superseded by filter-pressing, and a good many New Zealand mills now hold a front rank position in the matter of ore treatment. It seems strange, however, after trying so many variations of the cyanide process, that all hands have found it necessary to return to the starting point by adopting the system first introduced, at Karangahake, in the year 1889, by the patentees. Today the tendency is in the direction of abolishing amalgamation and concentration, and, in the mill of the future, there will only be one system of treatment, which will be confined to the cyanide process throughout, regardless of the character of the ore, provided it is all ground to an impalpable paste, and dealt with subsequently by agitation and filter-pressing.

PRECIS OF TECHNOLOGY

Artificial Precious Stones.—At a meeting of the Royal Society of Arts held on April 28, Noel Heaton read a paper on the manufacture of artificial precious stones, that is to say, the production of stones of similar chemical composition to the stones found in nature, not the imitations made from paste or strass. The paper is of special interest at this time because a Paris firm with a branch in London, known as Tecla, is placing upon the market artificial rubies and sapphires made from pure corundum, and also artificial pearls. Mr. Heaton in his paper mentions these pearls, but does not give much technical information, and we refer now particularly to the portion relating to the corundum stones. Incidentally he gave a historical account of the attempts to produce diamonds, and showed that Moissan and others had obtained microscopic crystals of diamond, and also of ruby, by heating certain mixtures to high temperatures and pressures, thus following the probable reactions that have taken place in nature. But all these processes, while of scientific interest, are of no commercial value. The system described by Mr. Heaton consists of building up a stone from tiny natural stones, fragments, and cutter's dust, and also from amorphous corundum, by means of the heat of the oxy-hydrogen blowpipe. As long ago as 1819 a book on the blowpipe by E. D. Clarke described how, if two pieces of ruby were placed upon charcoal and exposed to the blowpipe flame, they would melt into one bead. About 1870 Gaudin revived these experiments, and in 1885 stones were sold for a short time as 'reconstructed,' or 'Geneva,' rubies. The amount of skilled labour required in making them was so great that the cost was almost as high as that of the natural stone; and it was not until 1904, when Verneuil invented an automatic machine for conducting the operation, that the process became of commercial value. An outline of this apparatus is shown herewith. The principle on which it works is first to break the stones or cutter's refuse to powder, and then place a thin layer upon a small platinum disc. When this had been melted, more of the powder is allowed to drop gradually on to it. Twenty five years ago the addition of other grains was done by hand, a fact which accounted for the costliness of the operation. In Verneuil's apparatus the powder is contained on a sieve in the oxygen chamber, and an electrically operated hammer gives the sieve a series of gentle taps, allowing the powder to drop through the sieve at the pre-determined rate. This powder is carried along by the mixed gases to the fusion chamber, and is made to impinge, in the midst of the flame, upon the platinum disc. The disc is gradually lowered, and the melted material upon it, being withdrawn from the zone of fusion, begins to harden. The powder subsequently introduced by the blowpipe is fused upon the hardened mass, and thus slowly and by degrees a large stone is built up. This product is called a 'boule' and it is usually pear-shaped. It takes about half an hour to produce one weighing from 20 to 30 carats. The old experimenters were doubtful of the value of the stones thus produced, for they expected that their structure would be amorphous, and that they would lack the optical and physical properties of the natural crystal. Mr. Heaton however states that these properties are faithfully reproduced and that the 'boule' is a single crystalline individual. The only way an expert can differentiate the artificial from the natural is by a study of such gas bubbles as may be enclosed. In the natural stone these cavities are always found along the planes of crystallization with their axes parallel to the lines of

cleavage. Sometimes there are so many of these, parallel with each other in two directions in each plane, as to give the structure technically known as 'silk.' In the artificial stone the cavities filled with occluded gas from the blowpipe retain their spherical shape and are distributed irregularly through the mass.

A great advance in the application of this process took place when Verneuil discovered how to use amorphous corundum instead of the small pieces of natural



stone. A pure ammonium alum is prepared and introduced as fine powder, just as was the natural powder. The flame decomposes it by expelling the ammonia and the sulphuric acid, leaving a pure alumina. The stones thus formed are called 'synthetic' as distinguished from 'reconstructed.' In this process the colouring matter has to be considered. If none is introduced, the resulting stone is a white sapphire. In order to produce the ruby colour, a small proportion of chrome alum is added to the ammonium alum. For a long time the sapphire blue could not be produced. Cobalt was used as the base, but it was difficult to form its aluminate. This could be done by adding magnesia, but the presence of the latter resulted in making spinel, that is, magnesium aluminate, instead of corundum. Finally it was discovered that titanium oxide gave the required tint. Mr. Heaton's paper gives a large amount of most interesting information, and will repay study. Our space is limited and we have confined our abstract to the record of the first commercial artificial production of real corundum stones.

Geology of Porcupine. — The Miller and Searle

papers of April 10, 1906, and of May 10, 1906, respectively, in the *Canadian Journal of Science*, contain a description of the geology of the district.

along the southern edge of a vast clay belt. Geologically the district is similar to those in the Pre-Cambrian formations to the north of Lake Superior, and the ore deposits and their wall-rocks are in many ways like the typical gold-quartz deposits in California. The rocks in the vicinity of the veins are characteristic of the Keewatin and Huronian formations. The former are mostly altered igneous rocks, together with some altered sediments, and the latter are entirely altered sediments. Most of the gold discoveries have been made in the Keewatin. The veins in which gold is found consist chiefly of massive quartz, usually white, but sometimes bluish grey. Pyrite is associated with it and to a less degree sericite and calcite. The quartz has been subjected to strain; it is built up partly of coarse grains from $\frac{1}{2}$ to 1 mm. diam., and partly of finer grains $\frac{1}{16}$ mm. diam. The coarse grains commonly show numerous inclusions indicating that the solution from which it was deposited was of high temperature and of complex composition. They also exhibit strain shadows, showing that they have been subjected to deformation stresses subsequent to formation. The finer grains do not show effects of strain and they are comparatively free from included minerals. They are probably younger than the coarse grains. Some was produced by recrystallization under pressure not far from the original point of deposition, but other parts have been introduced from places farther afield. Gold is sometimes found completely enclosed in single coarse quartz veins, but is more often found in the fine-grain quartz. It is also found in the calcite and pyrite. Some of the pyrite is obviously as old as the coarse quartz, and the calcite while older than some of the gold is younger than the coarse quartz. The veins have been probably deposited from hot solutions such as are given off when a molten magma is intruded near the surface, but there is not in the immediate vicinity of the deposits any mass of igneous rock which has been formed from this magma. A few miles away, Willet G. Miller reports the presence of masses of granite which are intrusive into the Huronian; these may be genetically connected with the gold deposits just as in California where the deposits are found in metamorphic rocks a few miles from granite.

As regards the wall-rocks, the characteristic feature is the high percentage of carbonates and sericite. The walls are nearly always composed of secondary minerals. Those that are of light colour are composed of carbonates, sericite, and quartz, and the darker ones contain chlorite and magnetite. At the Rea mine, the dark rock merges into an igneous rock, showing altered crystals of plagioclase and hornblende, that was probably originally a hornblende andesite. At the Hollinger, the wall-rock is light, and was originally probably a silicious volcanic rock such as the quartz-porphry found in the neighbourhood. At the Dome, there is in addition to altered volcanic rocks, a conglomerate of which the matrix consists largely of carbonates, sericite, and quartz. The carbonates have been variously described as ferrodolomite, ferruginous dolomite, ankerite, and siderite, but as the content of iron is usually low the author considers ferro-dolomite the most suitable name.

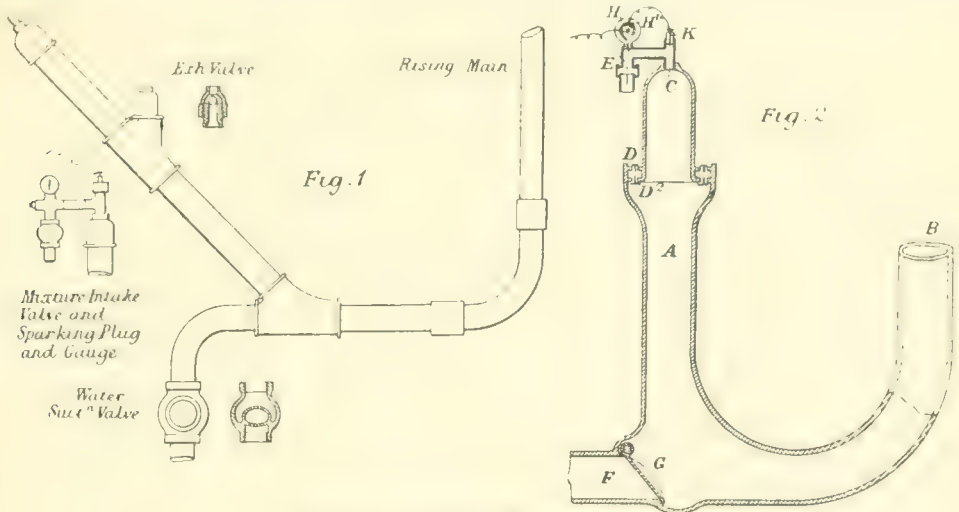
The various deposits can be grouped into four classes: (1) single-fissure fillings or veins, (2) intricately connected fissures forming a vein system, (3)

parallel fissures, and (4) a stock quartz vein forming an intricate network in a band of carbonates, and (4) spots of mass of irregular and irregular shape.

Removing Waste on the Rand. — An unnamed contributor makes some interesting comments in the *South African Mining Journal* for March 1 on the practice of removing waste at the mines of the western Rand, and he argues that where a lode is rich and thin there is a great danger, with hand sorting, of some of the best parts going to the waste dump. It is well known that on the small South Reef Leaders, especially in this part of the Rand, there is always a great discrepancy between the assay-values and the actual gold recovery; even after eliminating high assays the extraction is often 30 to 40% less than the estimated content. An examination of the stopes shows that the lode may not be more than an inch thick and may in some places entirely disappear. A careful sampler will, however, try these apparently barren places, and will get as good results as if the blanket was present. Investigation shows that the gold is found in the contact and in the quartzite on both sides of the blanket vein; consequently even when there are no pebbles gold is present. In mining these lodes, the stoping width averages 40 in., and much waste has to be removed on the picking-tables. It is easy to see that under the circumstances much of the quartzite from the contact may easily be rejected as barren, and also that if a piece of rock consisting of a thin layer of blanket attached to quartzite happens to lie on the table with the quartzite uppermost it stands a good chance of being removed. The author of the article is therefore of opinion that sorting should be abolished and the whole width of the ore broken sent to the mill.

Cyanide Manufacture. In the *Engineering and Mining Journal* for May 6, William Neill, manager of the Cassel Cyanide Company, Glasgow, gives some information about the manufacture of cyanide. This is an industry about which little is written, so that whatever is published is of interest, though the information given may be bald. Mr. Neill estimates that in 1910 one quarter of the world's production of gold was extracted by cyanide. On the Rand the yield by cyanide during that year was worth £11,552,743, a figure which is approximately the same as that for the total profit made at the mines, £11,567,099. He also estimates that £1,500,000 has been spent in Great Britain, the Continent of Europe, and America, on research and experimental work in connection with the manufacture and application of cyanide, and on the establishment of successful and unsuccessful factories since cyanide was first proposed in 1891. During these twenty years the price has gradually dropped from 2s. per lb. on 100% basis to 7d., and at the same time the quality has been notably improved. The first cyanide sold was dirty gray in colour and contained 20% of insoluble matter and 5% of cyanates. Nowadays sodium has displaced potassium and there are three grades, the first containing cyanide equivalent to 98 to 100% KCN, the second 120%, and the third 128 to 130%. The demand for the first-named is gradually diminishing, as consumers recognize the economy involved in the transit and use of the higher grades. The first and third are made in Great Britain, the Continent of Europe and in America, and are sold as a fused product. The second is manufactured on the Continent and, being obtained by a wet process, is formed into briquettes by pressure. The principal producers work on the Castner method using metallic sodium and ammonia as the basis of operation. In Great Britain a high-grade cyanide is made from

metallic sodium and ferrocyanide. The briquetted cyanide is a by-product of the beet-sugar industry. When the residue left after the extraction of the sugar is heated a gas is evolved that is rich in ammonia and hydrocyanic acid; the ammonia is collected as sulphate and the hydrocyanic acid gas is passed through caustic soda for the production of cyanide of sodium. It is notable that during the five years 1905-10 the efficiency of the cyanide process of extraction has been increased so much that though the output of ore on the Rand has doubled the consumption of cyanide has only increased 50%. The only other uses of cyanide are in connection with electroplating and as an insecticide in fruit growing. These industries are however relatively small, and the buyers still ask for 98% potassium salt in spite of its being dearer.



BADCOCK'S INTERNAL-COMBUSTION PUMP.

Badcock's Internal-Combustion Pump.—In our issue of January 1910, we gave some details of Humphrey's new pump for raising water by the direct explosion of a gaseous mixture above it. This direct application of gas-power has received the attention of many other investigators, and *Engineering* for May describes one invented by E. B. Badcock, of London. This design is notable for two reasons, one that the machine can be made, with the exception of the valves, from stock fittings, and the other that it works on a two-stroke cycle instead of a four-stroke, thus making the rate of action twice as great. Figure 1 shows the actual form of construction at its simplest, and Fig. 2 is a section merely for the purpose of explaining the action. The pump consists of an explosion chamber C, a suction pipe F and rising main B, inlet-valve E and exhaust valves D_1 , D_2 . These valves are automatic and independent, not requiring any interlocking gear to control the sequence of their operation. In the outward stroke the gas mixture is fired, the water is pumped, and fresh charge of gas mixture and water drawn in; during the inward stroke the burnt products are expelled and the new charge compressed. In following the course of the strokes, we begin with the rising main B full to the delivery tank, and a charge of gas mixture in C; this mixture is under the pressure of the static head in the rising main, the valve G is closed, the lower exhaust valve D_2 is held up to its seat, and the upper exhaust valve D_1 is inoperative.

If now the mixture is fired, the water is forced downward through A and up B. The products of combustion expand and thus become cooled; when their pressure is reduced to about that of the atmosphere, the valve D_2 opens of its own weight, the valve D_1 , remaining closed and so preventing the entry of air. When the pressure falls still further, the inlet valve E opens and a fresh charge of mixture is sucked in; this sweeps the burnt gases downward to a position below the valves D_1 , D_2 . At the same time the valve G opens and another charge of water is drawn in. By this time the momentum of the water in B has been exhausted and some of the water flows back into A, so compressing the burnt gases below and the fresh mixture above. The valve G shuts, the valve D is lifted and the burnt gases expelled. As the water continues to

rise, the fresh mixture is trapped and compressed, the valve D_2 is closed, and the cycle of operations begins again. One of the points suggesting inquiry is the fact that the burnt gases and the new charge of mixture are in the interior of the pump at the same time; the casual observer might consider that these would mix and reduce the efficiency of the machine, even if they did not entirely destroy its action. The inventor however shows that as the chamber is long and narrow, there is little chance of whirling eddies being generated. The article in *Engineering* gives many other details and drawings.

Production of Copper in North America.—In the *Engineering and Mining Journal* for May 6 W. K. Ingalls, the Editor, gives his final estimate of the production of copper in the United States during 1910, together with figures for the production in Canada, Mexico, and Cuba. Mr. Ingalls' figures are always of interest, for they are obtained quite independently of those published by the refiners and the metal merchants. They are compiled from reports supplied by the smelters and are calculated from the production of blister copper, and in the case of the Michigan production from the output of the refined metal. This method of calculating the production is the easiest for tracing the copper from its source. Mr. Ingalls notes that there is a difficulty in arriving at the exact source of some parcels of ore, but these are not large amounts, and the judgment of the statistician is usually suffi-

away. For the benefit of those who do not follow the copper market, we may add that practically the whole of the copper produced in North America is refined in the United States, and that the item, 'copper imported from other foreign countries' represents blister copper and matte coming chiefly from South America and Australia. The amount coming from the former is likely to increase but that from the latter is decreasing. The figures given for the output during 1910 by the American Copper Producers' Association were 648,286 tons, so that Mr. Ingalls' analytical figures are substantially in agreement.

PRODUCTION OF COPPER FROM NORTH AMERICAN ORES, 1910

Production from United States Ores :	Long Tons
Montana.....	127,786
Michigan.....	98,839
Utah.....	55,822
Nevada.....	28,516
California.....	20,443
Other States.....	19,774

Total..... 484,933

Production from Canadian Ores.....	23,434
" " Mexican Ores.....	61,516
" " Cuban Ores.....	3,482

Total Production from North American Ores 573,365

U.S. COPPER SMELTERS' OUTPUT, 1910.

From North American Ores.....	573,365
From Ores from elsewhere.....	18,739
From Scrap.....	4,895

Total..... 596,999

Deduct amount sent to refiners outside North America.....	581,885
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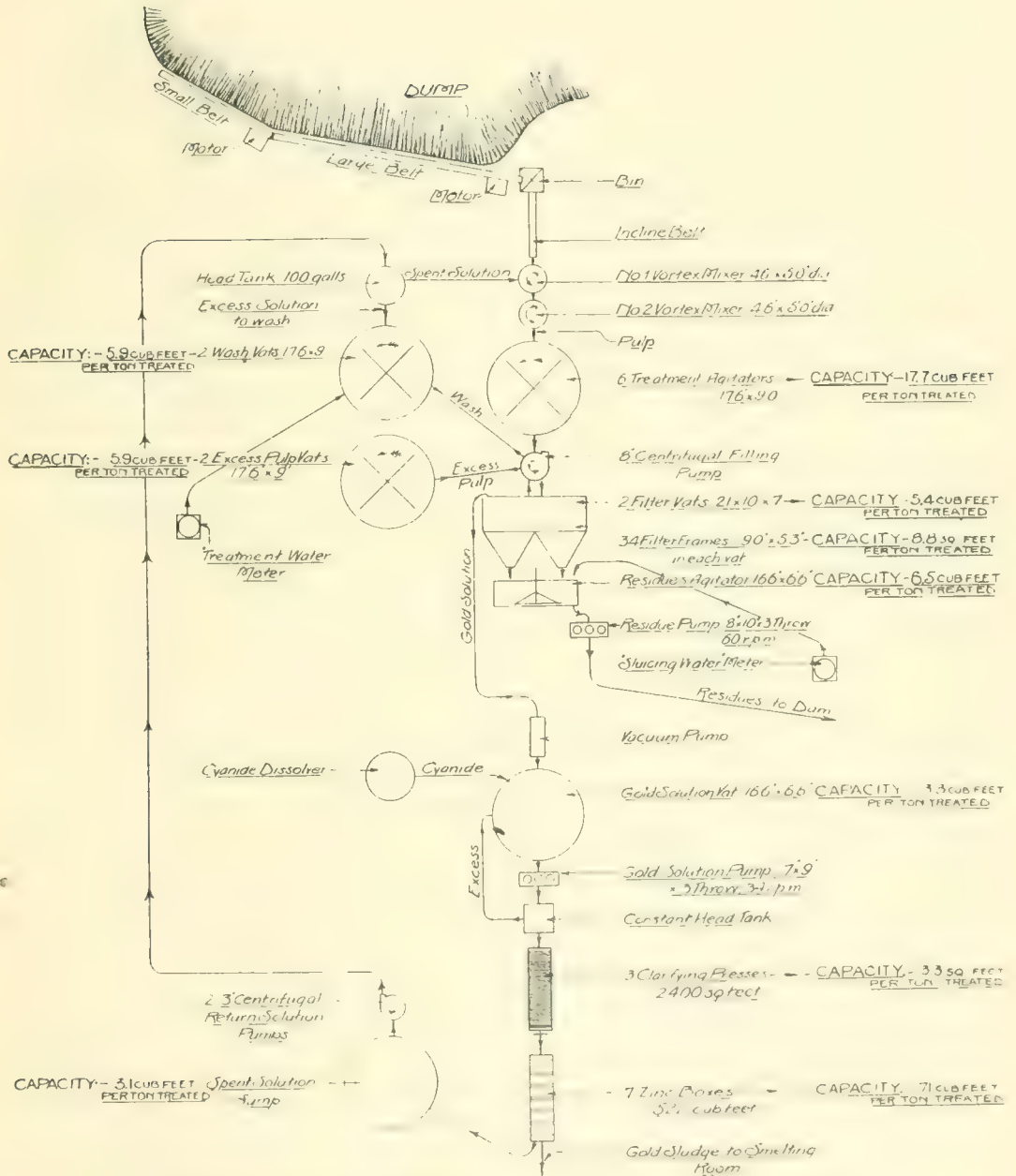
Add contents of blister copper imported from Australia, S. America, etc..... 65,261

Total output during 1910..... 647,146

Re-treatment of Tailing at Oroya-Brownhill—In the *Monthly Journal* of the Chamber of Mines of West Australia for March, T. B. Stevens and W. R. Degenhart describe the method and plant used for re-treating the dump at the Oroya-Brownhill, Kalgoorlie. The plant was erected at the end of 1908, and the dump then contained about 500,000 tons of tailing from the old filter-presses. The tailing consisted as to 92% of an all-slimed sulphide product that had been treated with bromo-cyanogen, and as to the remainder of roasted concentrate. The grade is described as the finest of sand, and only 2½% remains on a 100-mesh screen. The content of gold in the tailing averages 2 dwt., of which ½ dwt. is in the form of dissolved gold contained in the moisture. It was found after experiment that of the 1½ dwt. remaining undissolved only ½ dwt. could be extracted. An increase in the strength of the cyanide did not im-

prove the extraction. In fact a greater amount could not be recovered without re-treatment, the cost of which of course would make such a policy out of the question. The company is therefore content with an extraction of 1 dwt. by means of this re-treatment plant. The capacity is 730 short tons per 24 hours; the recovery is worth 4s. per ton and the cost is 2s. 1d. per ton.

The tailing is in the form of a conical heap and was originally stacked by a belt-conveyor. The treatment plant was built immediately adjacent, and the material, on being broken with a pick, runs down in rills on to travelling belts, the position of which can be altered as the dump grows smaller. The tailing is first discharged from the belt into a bin, and then it goes on an inclined belt to a vortex mixer, where it is broken up and mixed with spent solution. The mixer is 5 ft. diam. and 4 ft. 6 in. deep, and rapidly revolving cast-iron blades are driven by a vertical central shaft. Heavy foreign bodies, such as pieces of iron, accumulate at the bottom, and occasionally they are large and heavy enough to cause the breakage of a blade. Manganese-steel was tried for these blades so as to prevent breakage, but the result was that the shafting was distorted if the blade did not break, a more expensive accident. The pulp passes by a launder to another mixer of the same type, and on the way floating matter such as wood is skimmed off by means of screens. From the second mixer the pulp goes to six agitation vats, made of galvanized iron, the sides being corrugated. Circulation is effected by means of four angle iron arms revolving at 12½ rpm. The spent solution entering the mixers contains an equivalent of 0.04% KCN. Owing to the presence of magnesium salts, little protective alkalinity is possible, and only 1½ lb. of lime per ton is added. The pulp is agitated for 8 hours, after which the cyanide content corresponds to 0.02% KCN. The specific gravity of the pulp is maintained at 1.61, as thinner pulp gives no increase in extraction. The consumption is 0.47 lb. of sodium cyanide. The pulp is then pumped to two vacuum-filters each 10 ft. wide, 21 ft. long, and 7 ft. deep, the bottoms of each being divided into two discharge-hoppers. Underneath residue agitators are built in the ground. There are two storage reservoirs for excess pulp, that is, pulp remaining between the filter-frames and in the discharge hoppers after the cakes are formed. In filling the filters, it is customary to draw from the excess vats and the treatment vats concurrently. There are also two storage tanks for wash-water. These are fitted with agitator arms, as it is easier to maintain this agitation than to periodically remove the fine sand that would otherwise accumulate. Each filter contains 34 frames, 5 ft. 3 in. deep and 9 ft. wide, and set 6½ in. apart from centre to centre. About 22 short tons of cake are formed per charge in each filter, and 16½ charges are made in 24 hours in each, or 33 altogether. The frames are allowed to stand a day per month in 5% hydrochloric acid, so as to free them from lime. The cloths last 5-3 months, and have then to be discarded because they have become hard with sulphate of lime, which cannot be removed. The vacuum pumps deliver the gold solution to a storage vat, to which is introduced an extra amount of cyanide to the solutions, making it test 0.05% KCN. The object of doing this is that the precipitation is effected better from strong solutions than from weak ones in the zinc-boxes. Before this practice was adopted, magnesium hydroxide was precipitated on the zinc and so stopped its action. On the other hand, stronger cyanide had no increased effect in dissolving the gold in the agitator-vats, so for the



FLOW SHEET OF PLANT FOR RE-TREATING TAILING AT OROYA BROWN HILL

the author's figures are based on the average grade of the ore mined and milled at the Rand. The author's figures are probably as good as any that can be evolved, and they will serve the purpose of analytically examining the principle enunciated in the paper. The two facts on which Mr. Schmitt starts are the increased cost of mining and hauling with depth, and the steady decrease in the average content of the ore as the workings go down. His figures for the average grade of the ore mined and milled are given in Table I; these figures are admittedly the author's own interpretation of the official published returns.

Future Economies on the Rand.—A paper on this subject was presented by C. O. Schmitt to the meetings of the Chemical, Metallurgical and Mining Society of South Africa held in April, and of the Institution of Mining and Metallurgy held in May. The paper is a lengthy one, and may be divided into two parts; in the first part the author makes calculations as to the greatest depth at which mining can be profitably continued at the present scale of cost, and in the second he reviews the various possible ways of reducing the cost. One of the ways is by a closer sorting above and below ground; this is one of his special subjects, he having already treated it in full in a paper read last year and abstracted in our Précis in

TABLE I.

Vertical depth in feet	Content in Shillings.	
	For ore milled	Per ton milled after reduction at 10% waste
1000	34 00	40 00
2000	25 50	30 00
3000	21 25	25 00
4000	19 00	22 50
5000	17 00	20 00

TABLE II.

	ft.		ft.		ft.	
	80	50	90	5	100	5000
Mining costs	8 0	5 0	9 0	5	10 0	50 0
General expenses ...	1 25					
				2 0		2 0
				17 75		18 25
				22 5		20 0
				13 25		7 75
				0 475		0 175
Profit tax 10%	2 375	1 325				
Company's profit....	21 375	11 925				

May 1910. The other ways relate to improvements in milling, and the author reviews the propositions made by other metallurgists such as W. A. Caldecott, E. J. Way, and E. H. Johnson. These subjects have already been referred to in our columns, so we confine this abstract to the first part of Mr. Schmitt's paper. At the outset we may say that the figures and suppositions on which he bases his arguments are distinctly open to question, and many engineers will absolutely refuse to accept them. As however no one can generalize on the possibilities of the Rand at depth, the author's figures are probably as good as any that can be evolved, and they will serve the purpose of analytically examining the principle enunciated in the paper. The two facts on which Mr. Schmitt starts are the increased cost of mining and hauling with depth, and the steady decrease in the average content of the ore as the workings go down. His figures for the average grade of the ore mined and milled are given in Table I; these figures are admittedly the author's own interpretation of the official published returns.

At the present time the average recovery is 28s. per ton milled, and the working cost, including develop-

ment redemption but making no allowance for redemption of capital put on surface plant, averages 17s., leaving a profit of 11s., of which 9 9 shillings is available for distribution after allowing for the 10% profit tax. At the present time ore is extracted from workings at depths from a few hundred feet to 4000 ft., and the author takes 2400 ft. as the average. He estimates that the mining cost per ton milled will increase 6d. for every 1000 ft. vertical; he takes 8s. as the mining cost at present, that is at an average of 2400 ft., milling cost 5s., development redemption 2s., and general expenses 1 25 shillings. In addition to this total of 16s., there is the redemption of capital to consider. He goes into considerable detail in calculating the amount to allow for this purpose per ton of ore milled, and fixes on 4 5 shillings as the suitable figure. With all these data he figures out Table II., giving the profits to be expected at various depths. It will be seen that the profit at 4000 ft. is 4 275 shillings; this is less than the amount 4 5 shillings that should be set aside for redemption of capital. It is evident therefore that before 4000 ft. is reached the operations will have become unprofitable. We deal with this question in our editorial columns; our Johannesburg correspondent also refers to it.

CURRENT LITERATURE

Eagle Stope-Drill.—The *South African Mining Journal* for April 22 publishes Professor John Orr's report on his tests of the Eagle stope drill.

Allaying Rock-drill Dust.—In the *Engineering and Mining Journal* for May 13, E. M. Weston, of Johannesburg, gives a detailed description, with illustrations, of the Purser and Aymard devices for catching the dust from rock-drills, recently introduced on the Rand.

Brockway's Rock Drill.—*Mining Science* for May 18 gives details and drawings of H. A. Brockway's new rock-drill, that is being made in Denver.

Tin Dressing.—The *Mining Journal* for April 29 publishes a flow-sheet of the new metallurgical plant erected at Boswin mine in the Wendron district of Cornwall. We have already referred to the good work done here in reopening an old mine. The ore is crushed in two Holman air-cushion stamps, then sent to hydraulic classifiers; the coarse product goes to a Record table, the medium to two Wilfleys, the fine to a Frue vanner, and the slime to rag frames. The concentrates from all these are roasted and re-treated on tables, and the middlings are treated on buddles.

Concentrating Zinc Ore.—In *The Mining World* (Chicago) for May 13, Otto Ruhl describes the new concentrator built by the Hackett company, at Joplin, Missouri, for treating low-grade disseminated zinc ore, averaging not more than 4% zinc.

Monell Slime Tables.—The *Engineering and Mining Journal* for May 20 gives a short account of the Monell table used in Colorado for concentrating slime.

Imbert's Zinc Reduction Process.—*Mining Science* for May 18 reprints in full a paper read at the Congress of Technology recently held in Boston, by F. A. J. Fitzgerald, describing a furnace designed by him at Hohenlohehutte, Upper Silesia, for the purpose of working the Imbert process electrically.

Starting Silver-Lead Furnaces at Mapimi.—In the *Engineering and Mining Journal* for April 22, L. B. Harrison describes the method of starting the silver-lead smelting furnaces at Mapimi, in Mexico. Lead bars are stacked in the crucible to make a platform

and no molten lead is introduced. The method is said to combine the advantages of the molten-lead and platform methods and to eliminate the disadvantages of both.

Basic-lined Copper Converters.—In the *Engineering and Mining Journal* for May 13, Carr B. Neel supplements his article appearing in the issue of April 8, giving further results as regards the best position for the mouth of the furnace.

Greenwood Copper Smelter.—In the *Engineering and Mining Journal* for May 20, J. E. McAllister describes the copper smelter belonging to the British Columbia Copper Co., at Greenwood. The ore is low in copper and sulphur, but as it is self-fluxing, a concentration by fire at 40 to 1 is easily obtained.

Assay of Lead Alloys.—At the New York meeting of the Society of Chemical Industry held on March 24, A. G. Blakeley and E. M. Chance read a paper on the determination of lead in alloys containing antimony and tin.

Goldfield Consolidated.—In the *Mining and Scientific Press* for May 6, J. W. Hutchinson commences a series of articles describing in full detail the operation of the mill and metallurgical plant at the Goldfield Consolidated, Nevada.

Gold Nuggets in California.—In the *Mining and Scientific Press* for May 6, Alexander Del Mar gives a list of nuggets of 30 oz. or over, discovered in California. He asks for assistance in making this record as complete as possible.

Air-Agitation.—At the March meeting of the Chemical, Metallurgical, and Mining Society of South Africa, Robert Allen read a paper giving a comprehensive historical review of the air-lift as applied to the agitation of slime. In 1897, Caldecott and Kelly introduced an air-lift for aerating slime, and a number of plants were erected on the Rand; but all these vats were wider than high. He describes the tall vats invented by F. C. Brown, of New Zealand, the work of Grothe at Pachuca, and the inventions of Crosse, Paterson, and others.

Assaying Complex Gold Ores.—At the May meeting of the Institution of Mining and Metallurgy, A. C. Hoare read a paper describing experiments undertaken with a view to ascertaining how much gold is lost in roasting the assay-samples of complex ores before fusion.

Tube-Mill Practice.—In the *Engineering and Mining Journal*, for May 20, A. G. Quartano, of the Dos Estrellas, El Oro, discusses the economics of the use of mine quartz in tube-mills with ribbed liners.

Kingsbury's Riffles. *Mining Science* for May 4 describes the riffles used by L. Kingsbury, in Summit county, Colorado, in connection with sluicing operations. The riffles are made of angle-irons, loosely held together, and lying loosely in the sluice box. The passage of water and gravel makes them vibrate. It is stated that, by their use, fine gold is more easily recovered than with fixed riffles.

Mining in Ontario.—In the *Canadian Mining Journal* for May 15, W. E. H. Carter gives reminiscences of the gold mining operations in the Lake of the Woods district, Western Ontario, that attracted as much notice 12 or 15 years ago as Porcupine does today.

Gas Producers.—At the meeting of the Institution of Mechanical Engineers held in April 28, J. Emerson Dowson read a paper discussing the main types of gas producers. Mr. Dowson's long connection with the subject of gaseous fuel makes this paper of special interest.

BOOKS REVIEWED

THE PRACTICE OF COPPER SMELTING. By Edward Dyer Peters. Cloth octavo, 700 pages with many illustrations. New York: The McGraw-Hill Book Co. Price 21s. For sale by *The Mining Magazine*.

In 1887 Dr. Peters published his first book, entitled 'Modern American Methods of Copper Smelting.' A year or two after, an enlarged edition was issued, and in 1895 it was still further extended and its name changed to 'Modern Copper Smelting.' On his appointment as professor of metallurgy at Harvard five years ago, he made a new departure by preparing a book on the 'Principles of Copper Smelting,' which made its appearance in 1907. The present book is a companion volume and discusses the practical details of copper smelting. It does not consist of a systematic study of general practice, but is chiefly confined to the special experience of the author in connection with a few representative mines and furnaces and to the details of the results of experience gained by several eminent American metallurgists. As the author says in his preface, a complete work on the subject would be an encyclopedia, not a handbook, so he prefers to take a few select instances and to study them in detail. The book may be said to specialize on Butte practice with occasional references to Cananea. Naturally the copper smelters that are most willing to impart information are those who have big mines, and big reserves of ore readily amenable to treatment. Consequently the possessors of difficult ores will not necessarily find complete solutions of their problems in this or any other book. But there is such an enormous amount of practical detail discussed in a pleasant way that everybody, whether owners of simple sulphides or those who have complex gold copper ores containing such things as bismuth and antimony, will find a store of interesting and useful hints. As with Thackeray's novels you can open the book at any page and wherever you start you find it difficult to leave off. The style is easy and the meaning invariably clear.

As regards the contents of the book, electrolytic refining is omitted, and heap-roasting receives little attention because nothing has been done in this department since the publication of 'Modern Copper Smelting.' In the chapter on mechanical roasting special attention is given to practice at the McDougal installation at Anaconda. The author heads this chapter 'Roasting' but calls the machines 'calciners'; in his preliminary remarks he says that as used in America the word 'roasting' means the operation of expelling sulphur and producing an oxide, and that in English metallurgical literature the word is applied "to a stage of matte-refining where pigs of high-grade matte are subjected to a slow oxidizing melting for the production of a crude metallic copper called blister copper." The chapters on blast-furnace practice give a historical outline of modern furnaces, and describe the principles of water-jackets, hearths, tuyeres, blowers, charging-doors, etc. Then follow chapters on the reverberatory furnace with a discussion on its special functions as compared with the blast-furnace, one on the treatment of fine ore and concentrate, sintering, pot-roasting, etc., and one on modern bessemerizing. An interesting chapter is that on refining, by which is not meant the removal of gold, silver, and other substances electrolytically, but the final melting done for the purpose of producing ingots of the required toughness and other physical characteristics. This is a part of metallurgy which receives

the blast-furnace, by the action of the heat, a series of reactions takes place, which are described in detail. There is a case of the blast-furnace, and a case of the blast-furnace, and a case of the blast-furnace.

The first chapter of the book, on the subject of pyrite smelting, will be of interest to the student. The author introduces a new classification of effects, and shows that true pyrite smelting and semi-pyrite smelting are two distinct processes markedly differentiated instead of being considered unimportant variations of each other. True pyrite smelting has few applications, and coke smelting has practically disappeared, so that the bulk of blast-furnace work in America can now-days be classed under semi-pyrite smelting. Thus the portion of the present book devoted to this subject, and containing a discussion of it from the modern standpoint, is specially welcome. The author gives a new view of the operation of the furnace, discarding the old explanation of gradual preparation of the ore as it sinks. He shows that the column of sulphides and quartz sinks unchanged until a zone is reached where the temperature is sufficient to separate the former by melting; the molten sulphides on arriving at the oxidizing zone are immediately bessemerized, the oxidized iron combining with the silica and eating away the foot of the quartz column. Such molten sulphides as are not bessemerized fall to the bottom of the hearth as matte. On this basis, the author shows that in true pyrite smelting the unroasted ore is smelted wholly or partly by its own heat, so little coke being used that it does not arrive at the oxidizing zone; while in semi-pyrite smelting so much coke is used that some of it does arrive there and exerts an effect on the reactions. In true pyrite smelting as much iron is being fluxed with as little silica as possible, and in semi-pyrite smelting the effort is to flux as much silica as possible with a minimum of iron. The above is of course only a bare outline, and metallurgists will enjoy reading Dr. Peters' elaboration of the subject.

E. W.

WEST AUSTRALIAN MINING PRACTICE. By E. Davenport Cleland. Cloth quarto, 270 pages, with many illustrations. Kalgoorlie: The Chamber of Mines; London: *The Mining Magazine*. Price 25s.

The elaborate book on 'West Australian Metallurgical Practice,' by Robert Allen, published by the Chamber a few years ago, was a most valuable contribution to technical literature, and unfortunately it is out of print. The new volume now published on mining practice is fully equal in merit to its predecessor, and it may be accepted as a work both of current value and as a permanent record of the geology and methods of mining in one of the great gold regions of the world. Its accuracy and representative nature may be gauged by the fact that practically the whole of it has already appeared in the pages of the Chamber of Mines Monthly Journal and has been subjected to criticism. To put it more accurately, the book is based on the series of articles prepared by the author for the Chamber of Mines; these articles have since been amplified by the author and have been improved and completed by the additional information induced by publication.

There is one point in connection with West Australian mining practice that makes the book of special interest; that is, the mining fraternity in that region is more cosmopolitan than in any other mining centre. The early pioneers came from Victoria and New South Wales, and they were mostly of Cornish origin. Since then engineers from England, America, and elsewhere

have flocked thither, and have brought their varied experience to bear on the problems to be solved. Thus the eventual adoption of particular methods was not due to preconceived notions or to the desire to follow in father's footsteps. Before giving a resumé of the contents we should like to remark here that the book is written in such a way as to be of use to the student as well as to the man of experience.

The first chapter gives a comprehensive survey of the geology and ore deposits of the district, written by C. G. Gibson; we gave an abstract of this article as published in the Chamber of Mines Journal in our issues of July and August last. The next two chapters are devoted to shaft-sinking and timbering, vertical and inclined shafts being treated separately. The fourth chapter is devoted chiefly to head-frames, and gives a number of valuable working drawings; it also briefly refers to winding engines, air-compressors, drill-sharpeners, repair-work, etc. Chapter 5 deals with the excavation of flats or stations. Then follows an important chapter on mine development, after which comes a chapter on ore-chutes and passes. The chapter devoted to stoping contains an interesting discussion on the relative advantages on the flat-back, rill, and shrinkage methods, and compares the results obtained at nearly all the mines. Other chapters describe methods of underground transport, cages, skips, safety devices, signalling apparatus, sampling, diamond-drilling, explosives, ventilation, and sanitation. Finally there is a full description of the water-supply system, by means of which 5,000,000 gallons per day is pumped from a reservoir situated 300 miles to the west to the mines. It only remains to say that the illustrations are mostly reproduced from working drawings and give full details and dimensions.

CHRYSOLOITE ASBESTOS ITS OCCURRENCE, EXPLOITATION, MILLING, AND USES. By Fritz Cirkel. Paper covers, 315 pages, with many maps and illustrations. Ottawa: Government Printing Bureau.

This is a second and much enlarged edition of Cirkel's famous monograph on Asbestos published by the Canadian Department of Mines. It is devoted specially to a description of the asbestos deposits situated to the south of Quebec, describing the geology, enumerating the theories of its origin, and giving an account of the methods of mining and preparation for market. We gave an abstract of A. E. Barlow's theory of its origin in our February issue.

TECHNICAL METHODS OF ORE ANALYSIS. By Albert H. Low. Fifth Edition. Cloth octavo, 360 pp. New York: John Wiley & Sons; London: Chapman & Hall. Price 12s. 6d. For sale by *The Mining Magazine*.

This book has won a reputation for practical methods of ore analysis. The present edition has been revised in detail throughout and brought well up-to-date.

MINERAL INDUSTRY OF RHODESIA. By J. P. Johnson. Cloth octavo, 90 pages. London: Longmans, Green & Co. Price 8s. 6d.

The author of this book is well known as a writer on the geology and ore deposits of South Africa. The present book reviews the various deposits known in Rhodesia, but the accounts are brief and sketchy, and no maps or plans are given.

THE WITWATERSRAND SYSTEM. By W. E. Bleloch. Pamphlet and Map. London: E. Marlborough & Co. Price 42s. For sale by *The Mining Magazine*.

This treatise gives a full account of Mr. Bleloch's theories as to the Rand deposits and their possible continuation.

COMPANY REPORTS

Waihi.—The annual report of this mine now issued is of special interest at the present time. Briefly the position is that the 9th level is not developing well, and shareholders and speculators are alike anxious as to the future. As is usual, when calamitous times arrive, irresponsible people indulge in wild vituperation against anybody and everybody connected with the management and administration. In this case such accusations are baseless, and the only legitimate ground for a disagreement from the policy of the board is in connection with their disinclination to commission a mining geologist to make a scientific examination. The report now published covers the year 1910, and shows that 442,020 short dry tons of ore was sent to the three mills, where by amalgamation, cyanide, and concentration, 182,693 oz. gold and 1,339,707 oz. silver were produced, yielding an income of £926,099. The assay-value of the ore treated was 9.3 dwt. gold and 3.8 oz. silver per ton, and was

the power-house built. There will be six turbines, each rated at 1500 hp., and the current will be transmitted at 50,000 volts over the distance of 49 miles. The directors naturally felt some misgivings as to the advisability of completing this work, when the position at the mine became uncertain. They decided, however, that, though the mine is at an anxious period of its life, it is by no means moribund, so it would be best to go ahead with the construction, and they are providing the expense out of the reserve fund, so as not to interfere with dividends.

Waihi Grand Junction.—This company was formed in 1895 to acquire property adjacent to the Waihi gold mine, New Zealand. Three of the lodes found in the Waihi mine continue into the Grand Junction territory, namely, the Martha, Royal, and Empire. For many years the results of development work were disappointing and much capital was spent to no purpose. F. C. Brown, the manager, was succeeded at the end of 1909 by W. Frank Grace, who had previously reported on the property for parties intending to supply



WAIHI

worth about 6s. 5d. per ton less than that treated in 1909, when 416,813 tons was milled. The tube-mill efficiency has been improved, and coarser screens are used in the stamps. The daily duty per stamp has been increased from $4\frac{1}{2}$ tons in 1909 to 5 tons in 1910. Out of the total of 330 stamps, an average of 295 were employed. The batteries are not worked on Sundays. The profit for the year was £559,191, out of which £396,725 has been paid as dividend, being at the rate of 80%. This compares with £446,316, or 90%, in 1909, and £421,520, or 85%, in 1908, and is identical with the distribution for 1907. Since 1893 the dividends have totalled £3,957,836. After much consultation with the engineers, the directors determined to maintain the present rate of output until the end of June 1911, and then to reduce it to 1000 tons per day. With the present reserve of ore, this policy will provide work for the mills for two years from now, with the prospect of dividends at the rate of 40 or 45%. In the meantime, development work is to be conducted vigorously at depth. Progress with the new Hora-Hora hydro-electric scheme is well ahead. The water-channel has been excavated, and the foundations of

further capital. The report for 1910 shows that Mr. Grace has effected a radical change all round, and that the position and prospects of the mine have been improved out of all recognition. He did 13,092 ft. of development work, as much in one year as in the three previous years put together, and he increased the ore reserve by 71,750 tons, besides sending 84,226 tons to the mill, a far larger yearly extraction than ever before recorded. At the same time the working cost was reduced from 22s. 10d. to 15s. 3d. per ton. The cost of mining was reduced from 12s. 6d. to 7s. 7d. by altering the method of payment from footage of holes drilled to tonnage extracted, and the treatment cost was lowered by shortening the time occupied in air-gitation, with a concomitant reduction in cyanide consumption. As already stated 84,313 tons was sent to the mill; from this, gold-silver bullion worth £133,315 was recovered. Mr. Grace does not report the separate gold and silver output, but we can presume that the relative proportion of the two metals is the same as at the Waihi, though the total content is rather less. The profit for the year was £30,646, and a dividend at the rate of 5% has been paid.

[illegible]

Tennessee Copper.—The company belongs to the Lewishohn group and owns copper and sulphur mines near Ducktown, Tennessee. J. Parke Channing is one of the directors, N. H. Emmons is manager, and H. F. Wierum is consulting engineer. Operations started in 1901, and dividends were first paid in 1903. The ore averages $1\frac{1}{2}\%$ copper and it is high in sulphur. During the last two or three years, compulsion to suppress fume has come as a blessing in disguise, and the company has now a sulphuric acid plant not inferior to any in the world. Mr. Wierum states that the sulphur is now more valuable than the copper, and that the plant is nearly twice as big as any other chamber plant ever erected. The report for 1910 shows that during the year 405,463 tons of ore was raised, of which 288,089 tons came from the Burra Burra mine, 84,766 tons from the Polk County mine, and the remainder from the London and the Eureka mines. The amount of ore smelted was 424,197 tons of the company's ore, yielding 5548 long tons of copper, and 31,526 tons of custom ore, yielding 1851 long tons of copper. The yield from the company's ore was 29 lb. per ton, the lowest figure yet recorded. The development has about kept pace with extraction, and the ore reserve on December 31 was estimated at 3,183,671 tons. At the smelter, a new ore-bedding plant is nearing completion; this will be of great benefit to the acid works, as it will ensure regularity in the content of the gases. The first part of the acid plant was started in June, and the whole of it by the beginning of December. During the latter month the production of acid was 12,175 tons. It has been found advisable to build two additional Gav-Lussac denitrating towers. The profit for the year was \$547,157, out of which \$57,000 was paid as interest on bonds, and \$300,000 was distributed to shareholders, being at the rate of 6%. This brings the total distribution to shareholders to \$2,606,250.

Compagnie du Boleo.—This French company controls the celebrated copper mine on the peninsula of Lower California, Mexico. It is capitalized for 12,000,000 francs. During 1910 the output amounted to 365,000 tons of ore, as against 330,000 tons in 1909. The yield of copper declined last year to 3.55%, as against 3.79% in 1909. Owing to the larger tonnage, the production of fine copper rose to 13,000 tons, or 575 tons more than in 1909 and 400 tons more than in 1908, hitherto the best year. A sum of 852,258 francs was spent on the construction of the port, the liquid slag from the smelter being used as building material. Now the slag will be granulated, necessitating additional plant. The reconstruction and enlargement of the smelting works, begun in 1908, is nearly finished, and will be completed during the current year. The capital expended on land, cultivation, breeding of cattle and horses, etc., has aggregated 3,000,000 francs. Workmen to the number of 3783 are employed, including 203 Chinese. The report furnishes the following figures:

	Francs	Francs
Ore in stock.....	48,244	39,835
Copper and matte.....	3,548,128	3,315,190
Supplies in hand and on the way	8,088,059	8,136,245
Animals on farm.....	342,548	390,594

The large amount of capital absorbed in *approvisionements* or supplies may astonish many, but not those who have managed mines in isolated localities in a region that yields scarcely any food-stuffs.

Bucks Reef.—This company was formed in May 1909, by the Neumann interests, to acquire a small gold mine in the Gwanda district of Rhodesia. The original crushing plant consisted of two Tremain stamps, which were erected in an inconvenient spot. In May 1910, these were abandoned, and 5 new stamps, of 2000 lb. each, were put in commission, the capacity being thereby increased from 450 tons to 775 tons per month. The report for 1910 shows that 8026 tons of ore was milled, and that by amalgamation and cyaniding 14,612 oz gold was recovered. This was an extraction of 36 dw't. per ton, and the total value was £61,038. The cost was £27,923, and the profit £33,115.

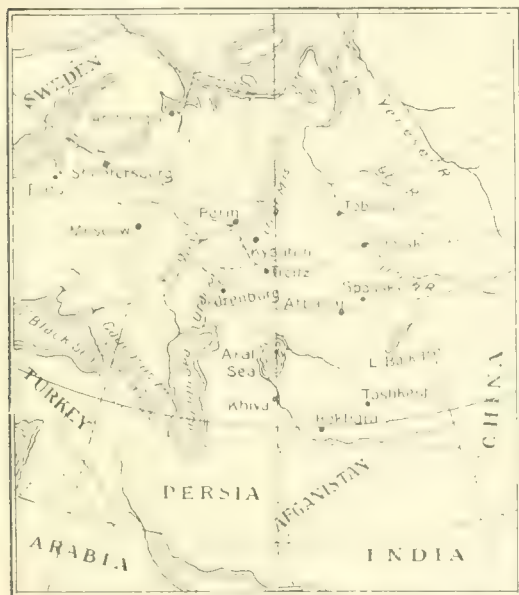
The dividend distributed absorbed £33,750, being at the rate of 22½%. The first dividend was paid a year ago, when 12½% was distributed. James Black, the manager, reports the ore reserve on December 31 in the Bucks and Prestwood properties at 9345 tons, averaging 23·8 dwt., measured over 32 in. This is a much lower content than that of the ore treated during the year, and the fall is due to the lower grade of the ore developed on the 6th level. As a compensation, No. 7 level is proving so far to be richer.

Spassky Copper.—This company was formed in 1904 to acquire the Spassky smelter, the Yuspensky copper mine, and the Karagandy coal mines, in the Akmolinsk district, Siberia. It was promoted and financed by the Siberian Syndicate, of which L. Ehrlich & Co. were the moving spirits. Reports were made by Pellew Harvey & Fell for the company, and by Edward T. McCarthy for the controllers. E. Nelson Fell was manager until two years ago,

the Siberian Syndicate. An account of the Atbasar mine was published in our issue of January 1910. The new move is intended to enable French shareholders in the Spassky to take an interest in Atbasar. In order to buy these holdings the capital of the Spassky company has been increased by £100,000 to £600,000. It is interesting to note that the holders of debentures in the Spassky company have been exercising their option to exchange into shares at £3 each, and within a short time it is expected that practically the whole of the £242,500 outstanding debentures will be extinguished in this way.

Alaska Mexican.—This gold mine is one of the Treadwell group, situated on Douglas island, Alaska, and is under the same control and management as the Alaska Treadwell and the Alaska United. The control is with the estate of the late D. O. Mills, and the head office is in San Francisco. The Exploration Company represents large share interests in England and on the Continent. F. W. Bradley is the consulting engineer, and Robert A. Kinzie is manager, of the group of mines. The report of the Alaska Mexican for the year ended December 15, 1910, shows that the mill of 120 stamps treated 222,698 tons of ore. The yield was worth \$776,079, or \$3½ per ton, of which \$395,502 was recovered by amalgamation and \$380,577 was contained in the sulphide concentrate, shipped to Tacoma. The cost of mining was \$271,638, or \$1·22 per ton, and the cost of milling, smelting of the concentrate, and general expenses, was \$118,461, bringing the total cost to \$390,099, or \$1·75 per ton. The profit was \$380,753, or \$1·71 per ton, and the dividend was \$342,000 being at the rate of 38% on the capital \$900,000. Since the beginning of operations in 1894, the tonnage treated has been 3,132,954, and the yield \$8,592,487, or \$2·74 per ton; the average cost per ton was \$1·76, and the profit \$0·98 per ton; during the same time \$2,742,381 was distributed. The ore reserve on December 15 was estimated at 1,093,029 tons, which includes the ore that has to be left in pillars. This includes ore from the 990 ft. to the 1320 ft. levels; there is also much ore in the 1430 ft. level, but it has not been sufficiently developed to warrant an exact estimate. During the year under review, the mill was driven by steam for 213 days and by water for 136 days, and the plant for supplying both sources of power has been extended and improved. The hydro-electric schemes are also in progress of completion. A new departure of importance is the adoption of a central hoisting system for all three companies, the Treadwell, Mexican, and United. For this purpose the main shaft of the 700 ft. Claim, belonging to the Alaska United, is being enlarged and deepened, and will be capable of handling 5000 tons per day from a depth of 3500 ft. With regard to the cyanidation of the concentrate, a plant to treat 100 tons per day has been built by the three companies conjointly. This plant is not yet in use, for a reason not explained in the report, this being that the contract with the Tacoma smelter has not yet been terminated.

Alaska United.—This paragraph should be read in conjunction with that preceding, as the interests of the two companies are intimately connected. This company owns the Ready Bullion and 700 ft. Claim mines. The mill belonging to the former has 120 stamps, and that belonging to the latter 100 stamps. The Ready Bullion mill treated during the year ended December 15 last 232,330 tons of ore, yielding \$281,877 of gold by amalgamation, and \$207,816 in sulphide concentrate, a total of \$489,693, or \$2·10 per ton. The 700 ft. Claim mill treated 184,156 tons and produced gold to the value of \$233,150 by amal-



WESTERN SIBERIA.

when he was succeeded by H. C. Woolmer. The copper deposit is a notable example of secondary enrichment, and the ore consists largely of chalcocite and bornite. Owing to difficulties in connection with transport and labour, the progress has been slow. The report now issued covers the year ended September 30 last. During this period 12,581 tons of ore was smelted, averaging 19·2% copper. Until May only one blast-furnace was at work, and since then two have been in operation. A third furnace was started after the close of the year under review. The installation of bessemer converters is being correspondingly increased. The production of copper was 2384 tons, which sold for £188,245, or £78·18s. per ton. It must be remembered that an import duty of £24 per ton makes it possible for the selling syndicate in St. Petersburg to obtain this high price within the Russian Empire. An interesting new move is the acquirement of a large shareholding in the Atbasar company which owns a copper property 200 miles away. The latter company was also promoted by

other small items of income, and the profit of the company for the year was \$252,446, out of which \$135,150 was paid as dividend, being at the rate of 15%, and a large amount was written off the property and plant account. The ore reserve in the Ready Bullion on December 15 was estimated at 1,754,340 tons, down to the 1800 ft level. In the 700 ft. Claim, the reserve was 865,223 tons, down to the 1320 ft.

The Elmore plant is a vacuum plant, and the Broken Hill plant is a flotation plant, being in all respects modern.

British Broken Hill.—This company has not been so successful as some of the others on the Barrier Range, New South Wales, and has often had to suspend operations when prices of metals were low. From December 1907 to June 1910 the mine was idle, but during the time the lead concentration plant was rebuilt and an Elmore flotation plant provided for the treatment of the zinc tailing. By the end of 1910 the plant had got into regular working order. The report now issued covers the last six months of 1910. During this period, 58,018 tons of sulphide ore, averaging 14.6% lead, 13.9% zinc, and 8.1 oz. silver, was treated, and produced 9124 tons of lead concentrate, assaying 63.2% lead, 7.8% zinc, and 25.6 oz. silver. The Elmore plant treated 33,428 tons of zinc tailing, averaging 4.2% lead, 16.3% zinc, and 3.9 oz. silver, and produced 9572 tons of zinc concentrate, averaging 11.3% lead, 41.6% zinc, and 10.3 oz. silver. Both the lead plant and the zinc plant took some time to get into proper working order, and the results obtained since the close of the year have been better than those in the half-year under review. The profit for the half-year was £16,334, out of which a dividend of 5% has been paid. The ore reserve is estimated at 410,000 tons. Development work is being prosecuted actively, and with varying results.

Zinc Corporation.—We have referred in our columns a great many times to the progress of this company. It was originally formed in 1905 for the purpose of treating zinc tailing at Broken Hill. The processes at first adopted were not successful, and it was not until the Elmore vacuum plant was installed that shareholders received some return for their money. We gave a full account of the position of the company in our issue of June 1910, and showed that the Elmore plant had saved the situation, and had earned dividends for the shareholders. During the last few months we have recorded that the Elmore plant is to be dismantled, and that of the Minerals Separation substituted. The latter process has been successful at the Central Mine of the Sulphide Corporation at Broken Hill, but the reason for its adoption by the Zinc Corporation is that an old contract of five years ago is being enforced by the Minerals Separation Company. The report of the Corporation for 1910 shows that 270,637 tons of zinc tailing was treated; of this 185,917 tons came from the Block 10 dump, 73,223 tons from the British Broken Hill dump, and 11,482 tons from the South Silver. The concentrate obtained assayed 43% zinc, 10.6% lead, and 14 oz. silver. This was re-treated on Wilfleys, and the commercial products were 85,625 tons of zinc concentrate assaying 46.7% zinc, 5.4% lead, and 11.4 oz. silver, and 9319 tons of lead concentrate assaying 56.3% lead, 16% zinc, and 38½ oz. silver. These

figures refer entirely to the Elmore plant, and were available at the time of the report for the performance of the substituted plant. The directors mention that the property of the Broken Hill South Silver is to be acquired, particulars of the transaction were given in our May issue. The income from sale of concentrates during 1910 was £324,040, and the profit was £97,906, out of which £89,513 was distributed as dividend at the rate of 50% on the preference shares. For the previous year the preference shares received 25%. They are entitled to 100% dividend before the ordinary shareholders get anything.

Golden Horse-Shoe.—The report of this company operating at Kalgoorlie covers the year 1910. Much interest has recently been evoked by the difference of opinion between the directors and the manager on the one hand, and Henri Kuss, the French engineer, deputed by the board to examine the mine, on the other. A year ago the production suddenly fell off, and the official explanations were not satisfactory, so in deference to the French shareholders, Mr. Kuss was asked to make an independent examination. We have already referred to this subject in our editorial columns. The report for 1910 does not mention this matter. During the year, 257,333 long tons of ore was raised and sent to the mill, and the total yield was 97,829 oz. The yield per ton was 32s. 3d., and the cost was 23s. 2d. per ton. The revenue was £415,294, and the profit was £75,294, out of which £75,000 has been distributed as dividend, being at the rate of 5% on the capital of £1,500,000. In addition to this share capital, the mine is saddled with a debenture debt of £100,000. On December 31 the ore reserve was 803,151 tons, containing 9½ dwt. per ton. The results for the year were disappointing as compared with those of the last ten years. In 1909, the yield was 142,725 oz. or 50% more than in 1910 for the same amount of ore milled. From 1899 to 1909 the dividend averaged £250,000 per year, and in 1909 it was £240,000, so that the fall to £75,000 marks an epoch.

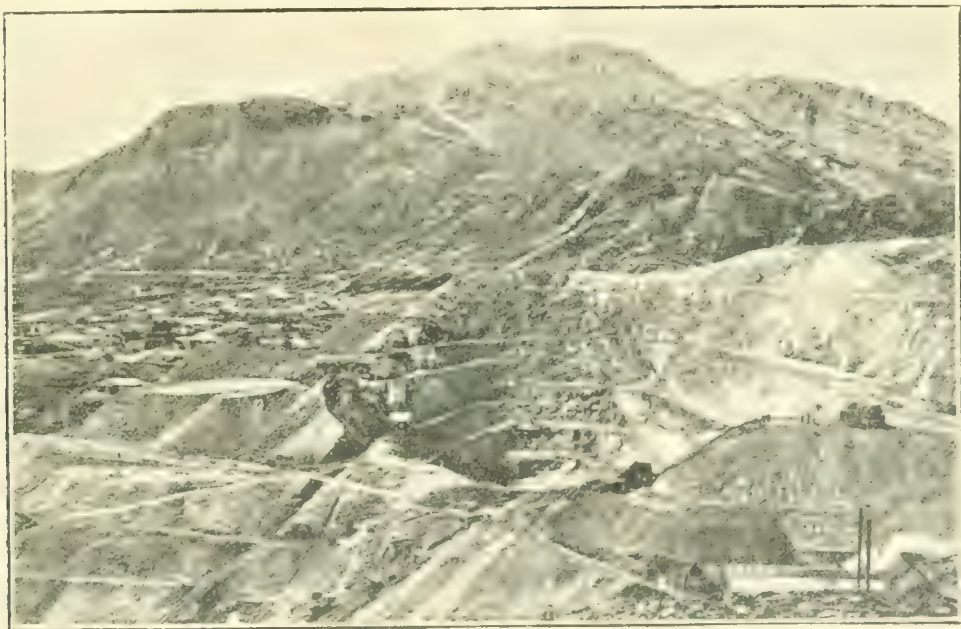
Anaconda Copper.—The report of this company for 1910 is of special interest, as it is the first published since the great amalgamation in the spring of that year. It will be remembered that in March 1910 it was decided to consolidate the Anaconda, Boston-Montana, Washoe, Butte and Boston, Parrot, and other companies, and for this purpose the share capital of the Anaconda was increased from 1,200,000 to 6,000,000 shares of \$25 each. Economies have already been effected, and more will be done in this direction during the next two years; but even a greater advantage is the settlement of long continued disputes as to the ownership of several orebodies. Following on the amalgamation came the purchase of adjoining property belonging to W. A. Clark. The mines belonging to the expanded Anaconda are now worked in four separate groups, namely, the Anaconda, Boston-Montana, Butte and Boston, and Parrot. The ore raised during the year amounted to 3,326,227 tons. No less than 33 miles of development work was done, and the reserve disclosed was greatly in excess of the ore mined. A large air-compressing plant has been built, and is probably at work by now; in future the hoisting is to be done entirely by compressed air. Smelting was done at Anaconda and at Great Falls; during the year, 3,302,523 dry tons was treated at the former, and 1,035,165 tons at the latter. Of the total, 385,200 tons was purchased ore. The metal output at the two smelters was 119,021 tons copper, 9,534,888 oz. silver, and 57,259 oz. gold. The deliveries during the year to customers brought a revenue of \$30,943,508, and the unsold stock on hand on December 31 was

entered at \$14,736,503, the gold and silver being valued at market price, and the copper at cost. The profit for the year was \$5,720,902.

Mount Lyell.—The half-yearly report of this company, operating the celebrated copper mine in Tasmania, covers the six months ended March 31. During this period, 117,892 tons was raised from the Mount Lyell mine, and 65,202 tons from the North Lyell, making a total of 183,094 tons, averaging 2.63% copper, 1.76 oz. silver, and 0.58 dw. gold per ton. The production at the smelter was 4112 tons of blister, containing 4063 tons copper, 298,458 oz. silver, and 5357 oz. gold. Less ore was treated during this period, but the higher average content due to more high-grade ore being mined made the production of copper 35 tons greater than during the previous half-year. In addition to the ore sent to the smelter, 688 tons of Mount Lyell ore and 5914 tons from the Ches-

cently been sent to the United States for refining, but it is now being treated at Port Kembla, New South Wales, a new departure which is of great importance in the world's copper market.

Namaqua Copper.—This company owns mines at Concordia, Little Namaqualand, on the western side of Cape Colony, not far from those of the Cape Copper Company. Operations started in 1887 and satisfactory profits have generally been made. In 1908 and 1909 however there was no profit owing chiefly to the low price of copper. At the end of the latter year it was decided to work only one of the two blast-furnaces and to treat only the better quality of ore. This policy has resulted in a profit for 1910. During the year 30,539 tons of ore and concentrate was smelted, yielding 4907 tons of matte, which contained 2474 tons of copper. The matte was shipped to the Cape Copper Company's smelting works at Briton-



Mount Lyell

ter mine were sent to the chemical works for the manufacture of sulphuric acid. In our notice of this company in our issue of December last, we mentioned that 787 tons of copper remained unsold on September 30 last. This copper has since been sold and has realized £58. 10s. 6d. per ton. Of the copper produced during the half-year now under review, 2867 tons was sold at an average price of £57. 3s. 3d. per ton, leaving 1196 tons unsold at the end of the half-year. The net profit for the six months was £85,775, a figure slightly less than during the previous half-year, and £30,000 less than during the same period a year ago. The dividend is £75,000 or 1s. 3d. per share, the same as for the period ending September 30 last. The smaller profit is obviously due to the lower price of the metal, and also to the amount of copper left unsold at the end of the half-year. The cost of producing blister copper was 17s. 8d. per ton of ore, an increase of 3d. per ton as compared with the previous half-year. The blister copper has until re-

ferry, South Wales, for treatment. Developments at the chief mine, the Tweefontein, have rather more than kept pace with the output, and on December 31 the reserve was estimated at 94,883 tons averaging 7½% copper. At the other mine, the Wheal Julia, there is a reserve of a few thousand tons, but development operations have been suspended. Both mines contain much low-grade ore that is difficult to concentrate; some of this can be smelted direct in times of high prices for the metal. The profit for the year was £34,794. This was derived not from the ore treated by the smelter as reported above, but from 2634 tons of copper produced during the year. The dividend was at the rate of 12½%, and absorbed

New Primrose.—This mine belongs to the Barnato group and is in the eastern part of the central Rand, immediately to the east of the Simmer & Jack. Milling began in 1889 and since 1895 the mill has consisted of 160 stamps. Unlike many of the mines on

after the removal of 16% waste, 257,168 tons was sent to the stamps, of which an average of 133 were in operation during the year. The assay-value of the

gold was recovered. In the cyanide plant, 171,921 tons of sand yielded 25,325 oz., and 84,459 tons of slime yielded 6035 oz. In addition 53,163 tons of accumulated slime yielded 5601 oz. The total production from current operations was 93,572 oz., worth £398,050, and from accumulated slime the revenue was £23,792. The cost was £205,202 on current operations, and £6362 for treating accumulated slime. The profit for the year was £210,278, out of which £185,000 was distributed as dividend, being at the rate of 60%. As compared with the previous year, the working cost shows a decrease of 1s. per ton milled, and an increase in the total profit of £34,261. The development done during the year has not given promising results. Most of the work was done in the Southern Series, and the deposits have been found to be low-grade and patchy. Part of the Main Reef is still to be developed in the western end of the mine. The estimate based on area gives four or five years life to the mine. The ore reserve on December 31 was calculated at 490,809 tons, averaging 7·8 dwt. Since writing our review of this mine a year ago, J. Harry Johns has retired from the position of consulting engineer to the Barnato group, and the position is now held by James G. Lawn.

Witwatersrand Gold.—This company was formed in 1886 and milling started in 1888. From 1891 to 1896 no milling was done and attention was devoted to development work. The capacity of the plant has gradually been increased and the number of stamps is now 220. The mine is situated on the outcrop in the eastern part of the Rand just to the west of the East Rand Proprietary, and the control is with the Barnatos. The mine is commonly known as Knight's. Regular dividends have been paid since 1905. The report now issued covers the year 1910 and shows that 553,152 tons was raised, and after the removal of 20% waste, 426,910 tons was sent to the mill. The yield by amalgamation was 67,363 oz., and by cyanide 46,331 oz., making a total of 113,694 oz., or 5·32 dwt., equal to 22s. 7d. per ton. The revenue from the sale of gold was £483,546, and the cost was £285,853. The dividend absorbed £148,750, being at the rate of 35%, and other items charged against profit were £15,932 profits tax, £31,826 depreciation, and £6033 expense connected with the flooding disaster. The working cost was 13s. 4d. per ton, which is 1s. 1d. less than during 1909. The ore reserve was re-estimated in December, and owing to the decrease in cost it was found possible to include blocks of ore that had previously been deemed unprofitable. The estimate was 1,232,784 tons, averaging 5½ dwt. During the year the development of the southern extension of the property was commenced. This ground measures 8200 ft. on the dip and is 1400 ft. wide. For the purpose of development, an incline winze is being sunk from the end of a crosscut that starts from the bottom of the main shaft, and a new shaft is to be sunk from the surface about half-way along, calculated to cut the deposit at a vertical depth of 2250 ft. James G. Lawn is consulting engineer, and W. M. Prout is manager.

Knight Central.—This mine is a deep level in the east central part of the Rand and adjoins the outlying

Mine, and is a part of the Witwatersrand Gold Mines, as particularly which are given in the foregoing paragraph. The mine, with the New, in all, 100 stamps, and cyanide accessories was started early in 1909. Two shafts have been sunk and have cut the Main Reef series at 1958 ft. and 2245 ft. respectively. The report for the year 1910 shows that 324,412 tons was mined and, after the removal of waste, 302,228 tons, averaging 5½ dwt., was sent to the mill. The recovery by amalgamation and cyanide was worth £344,325, being 5·45 dwt. or 22s. 9d. per ton milled. The content of the ore was about 1 dwt. less than in 1909, but at the same time the working cost was reduced from 18s. 11d. to 17s. 6d. per ton. The profit was £79,011, or 5s. 2d. per ton milled. The dividend absorbed £45,000, being at the rate of 5%; this is the first dividend declared by the company. The development during the year is reported by S. C. Thomson, the consulting engineer, as not having come up to expectations, and consequently the metallurgical plant has not been extended as rapidly as intended. One tube-mill however has been added, bringing the monthly capacity to 36,000 tons. On December 31 last the ore reserve was calculated at 700,000 tons, averaging 6 dwt.

Jupiter.—This is another of the new mines on the Rand that finds its operations hampered by the scarcity of native labour. It is a second deep level below the Geldenhuis Deep and belongs to the Consolidated Gold Fields group. It is worked in conjunction with its neighbour the Simmer Deep, and the two mines have a joint plant of 300 stamps, 100 of which treat Jupiter ore, and 200 treat ore from Simmer Deep. Milling started in September 1908. In recording the progress a year ago, we mentioned that the capacity of the joint plant was to be doubled so as to crush a total of 120,000 tons per month. Since then the plans for expansion have been modified, and the new plant as at present devised will bring the amount crushed to 108,000 tons per month. The report of the Jupiter company for 1910 shows that an average of 88 stamps were at work. The amount of ore raised from the mine was 267,379 tons, and 44,259 tons was taken from the surface dumps of development ore; out of this total 14% was removed by sorting, and 267,398 tons sent to the stamps. The yield by amalgamation below the stamps and tube-mills was 44,139 oz., and by cyaniding 30,146 oz., making a total of 74,285 oz., worth £311,265, or 23s. 3d. per ton milled. The working expenses were £270,992, or 20s. 3d. per ton. The net profit was £46,879, which was carried to the balance sheet. On referring to last year's report, it is seen that the working cost has risen 4s. per ton. This increase is due to two causes. In the first place, less ore from the dumps is now being treated, and second, the native labour force is insufficient and inefficient. With a view of improving the situation, stoping-drills are to be introduced, and a 50-drt air-compressor has been ordered. Owing to this rise in cost, it has been necessary to eliminate from the estimate of ore reserve over 200,000 tons, averaging 4 to 4½ dwt. per ton, so that the figures for the reserve on December 31 were 1,074,000 tons, averaging 5·8 dwt., and 320,000 tons of partly developed ore, averaging 4·96 dwt.

Simmer Deep.—As recorded in the preceding paragraph, this mine shares a reduction plant with its neighbour the Jupiter. During 1910 it has experienced the same troubles, owing to shortness of native labour supply, so that not only have underground costs advanced but the mill has not been running at full capacity. The report shows that 483,663 tons was mined and 46,662 tons taken from the dumps; after

the removal of 9% waste, 480,803 tons went to the stamps, of which an average of 165 out of 200 were at work. The yield of gold by amalgamation and cyaniding was 109,671 oz., worth £460,057, being an extraction of 19s. 1d. per ton milled. The working cost was £399,344, or 16s. 7d. per ton, leaving a profit of £60,712, or 2s. 6d. per ton. As with the Jupiter, no dividend has yet been paid. The ore reserve on December 31 was estimated at 1,255,000 tons averaging 5 dwt., and there was also 114,000 tons of partly developed ore averaging 5½ dwt. The consulting engineer, G. D. Leslie, is inaugurating a system of stoping drills, run by white labour, similar to that introduced by him at Robinson Deep two years ago when he was the manager of that mine. In order to improve the working conditions underground, a Sirocco fan is to be erected. It is also worth noting that amalgamation plates have been removed from below the stamps, and that stationary plates have been substituted for shaking tables below the tube-mills.

tional property from the Orient syndicate adjoining the mine to the east, and developments here are giving good results. They have also decided to increase the plant, so as to cope with the output from this new ground. The report for 1910 shows that 580,920 tons was mined, and after the rejection of 20% waste, 466,882 tons was sent to the mill. By amalgamation 103,983 oz. was recovered, and by cyaniding 52,129 oz., making a total yield of 156,112 oz., worth £663,612, 6½ dwt. or 28s. per ton milled. The working cost was £375,035, or 16s. per ton milled, leaving a profit of 12s. per ton milled, as compared with 13s. per ton in 1909. The dividend was £218,250, being at the rate of 22½%, as compared with 25% in 1909. Under the present circumstances it is natural that Mr. Way and the manager, Alexander Davidson, give full details of recent development work. On December 31, the ore reserve was calculated at 1,397,412 tons, averaging 6.46 dwt., as compared with 1,138,599 tons, averaging 7½ dwt. the year before.



New Kleinfontein.—This mine belongs to the Anglo-French Exploration group and is situated on the outcrop in the far east Rand. E. J. Way is the consulting engineer, and his work in connection with the metallurgical treatment of Rand ore is always of interest. At Kleinfontein he adheres to fine grinding by stamps and he has no tube-mills; whereas at the adjoining Benoni, belonging to the same group, he has designed a plant consisting of coarse-crushing stamps, and tube-mills, an outline of which was given in our Précis last month. Milling started at the Kleinfontein in 1894, but the plant was destroyed in the war. In 1904 operations were recommenced with 220 stamps. The report for 1910 now issued shows that recent development work has given rather poor results, and that the average grade of the ore sent to the mill has been slightly lower, with the result that profits have been reduced. Development work has been disappointing in the central and western parts of the property, owing to faults and dikes, but the eastern end has not shown any of these adverse signs. More recent work has been encouraging in the central and western parts. The directors have purchased addi-

Crown Mines.—This company is a consolidation of a number of Wernher-Beit-Eckstein mines on the Rand, namely, Crown Deep, Crown Reef, Langlaagte Deep, Robinson Central Deep, Langlaagte Royal, and Paarl Central. The amalgamation was effected in July 1909, so that the report for 1910 is the first that covers a complete year. The results so far obtained have not been as successful from the point of view of output and profit as was expected, a fact due partly to the expense of re-arranging the underground work, and even more to the scarcity of native labour and the higher wages paid. Accidents in the shafts also caused an interference with the output. The development work has been prosecuted actively, and during the year, 3,882,239 tons, averaging 7.3 dwt., was added to the reserve, which on December 31 stood at 6,282,719 tons, averaging 7.6 dwt. The various batteries, containing 675 stamps in all, treated 1,510,070 tons of ore, estimated to contain 8.37 dwt. gold, and the yield by amalgamation was 432,252 oz., or 5.71 dwt. per ton milled. The cyanide plants extracted 177,459 oz., or 2.35 dwt. per ton. The total yield was 609,711 oz. or 8.05 dwt. per ton, worth £2,555,047,

has been spent on capital account for the purpose of increasing the productive capacity of the mine. The year under review being £491,711. The dividend for 1910 was £1,128,127, being at the rate of 120% on the nominal capital of £940,106.

Ferreira.—This is one of the oldest of the outcrop mines on the central Rand, and is the neighbour of the Robinson and Village Main Reef. In early days, the yield was 1½ oz. per ton, and even now, in the closing years of its life, the content is not less than 8 dwt. The report for the year 1910 shows that the ore reserve on December 31 was 598,671 tons averaging 5½ dwt. per ton milled, as against 2½ dwt. the year before. In addition there is about 40,000 tons, averaging 7 dwt., broken or packed in the stopes. During 1910, 390,526 tons was mined. Until December the mill had been working at full capacity, and since then, 100 of the 120 stamps have been kept going, making a profit of £17,000 per month. It is expected that an average profit of £15,000 per month will be made during the remainder of the current year. During 1910, 390,536 tons was mined, and after the removal of 11% waste, 346,150 tons was sent to the mill. The yield by amalgamation was 90,760 oz., an extraction of 5½ dwt. per ton milled, and by cyanide the yield was 43,454 oz., an extraction of 2½ dwt. per ton milled. The total yield was 134,214 oz. or 7½ dwt. per ton milled, the percentage of extraction being 93%. The income was £564,375, or 32s. 7d. per ton, and the cost was £272,619, or 15s. 9d. per ton, leaving a profit of £291,756, or 16s. 10d. per ton, out of which £285,000 was paid as dividend. The yield per ton was 6s. 11d. less than in 1909, and the expense was 6½d. greater. The workings are being kept in thorough order, so as to extract as much of the remaining ore as possible. No. 1 and No. 2 shafts have been re-timbered, and sand-filling is being continued in order that the pillars and packing may be removed. The directors' report gives a synopsis of the results from 1888 to date. The tonnage mined has been 3,678,740, and the tonnage milled 2,900,828. The production has been 1,993,233 oz. or 13½ dwt. per ton milled, worth £8,277,570, and the amount distributed as dividend has been £3,729,250.

Village Deep.—This mine is on the dip of the Village Main Reef in the central part of the Rand. It belongs to the Rand Mines group the control of which is with Wernher-Beit and Ecksteins. The company was formed in 1898 but it was not until 1905 that production commenced. During 1905 the crushing plant consisted of 85 stamps. In 1908 the number was raised to 180, and since then tube-mills have added to the capacity of the plant. The report for 1910 shows a continued increase in the ore mined and treated, but the amount of gold won per ton decreases, and the profit per ton continues small. During the year 595,942 tons was mined and, after sorting, 508,540 tons was sent to the mill, estimated to contain 6½ dwt. gold per ton. The yield by amalgamation and cyaniding was 148,060 oz., or 5'83 dwt. per ton milled, worth £620,547, or 24s. 5d. per ton. This was 6d. per ton less than in 1909. The cost was £466,480, or 18s. 4d. per ton, the same per ton as last year, leaving a profit of £154,067, or 6s. 1d. per ton, so that the profit per ton was 6d. less than in 1909. The dividend absorbed £106,067, being at the rate of 10%. The first dividend was paid on the 1908 results, amounting to 10%, and in 1909, 15% was paid. The capital is £1,060,671 in

all, and the balance of £1,000,000 is held in reserve. The report for 1910 shows a production of 61 dwt. The developments at depth in the vicinity of the new Turf shaft are reported to be gratifying. The policy is to narrow the stope width, and to put all the mining work on single shift with 'one man one job.' The stope width has already been markedly increased. Sand-filling has been started and the stopes near No. 1 shaft have been filled, so making this shaft quite secure. The Sirocco fan recently installed is giving most satisfactory results as regards the ventilation underground.

TRADE NOTES

Most of the trade publications mentioned in this column are available for distribution, and the manager of "The Mining Magazine" will be pleased to secure copies for persons interested.

Fraser & Chalmers, Ltd. have issued a pamphlet giving particulars of the "Konomas" Rock Drill which was developed during the stope-drilling contests in South Africa.

The British Niclausse Boiler Co., Ltd. describe their automatic stoker in Catalogue No. 2. As a general rule mine-operators do not devote as much attention to power economy as their fellow engineers in industrial plants.

Fraser & Chalmers, Ltd. are adopting a useful practice in issuing their general catalogue in Spanish. Mining is extending rapidly in many of the lesser known Spanish-speaking countries and machinery firms do well to advance their interests in this way.

The Westinghouse Co. has issued a publication on Electricity in Mines which includes a complete report of the findings of the Departmental Committee appointed to report on the "Application of Electricity in Mines."

Automobile Owners will find F. Reddaway & Co.'s catalogue on Tyres of considerable interest. We do not specialize in reading matter likely to interest motor owners only, but our attention has been called to this catalogue on account of the three pages of notes on "Maximum Mileage." Mining Machinery firms would do well to include in their catalogue similar instructive points on the use of their machinery.

The Wilfley Mining Machinery Co.'s Bulletin No. 63 gives full particulars of the Shellok Process of Fuel Briquetting. Many advantages are claimed over other briquetting machines and these are explained in detail.

The Seager Engine Works have equipped their plant for the manufacture of Petrol Winding Engines and Bulletin No. 39 describes the Olds-Close Mine Hoist. It can be sectionalized for mule-back transport. This company have heretofore specialized in automobile engines.

The Worthington Pump Co. report a large number of recent orders for Natural Draught Cooling Towers, Surface Condensing Plants and Centrifugal Pumps. These machines are to be installed in England, India, South America, and on the Continent, chiefly in industrial and government works.

Dressing of Ores by the Dallemagne process is the subject of a well-printed pamphlet distributed by Ore Dressing Plants Company of Paris. Particulars are given of the Dallemagne concentrating table which is particularly designed to treat ore which requires extremely fine grinding to separate the constituent minerals. The table is oscillated at a high rate.

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